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FEBRUARY 1991

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- Dell's mail-order workstation
- UNIX for DOS power users
- Data communications software

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AT&T battles for NCR

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Plain-talking analyst Esther Dyson is one of the computer industry luminaries we ask to clarify the meaning of open systems, on page 48. If you're still confused, see our own explanation as Editor-in-Chief David Flack tries again in his editorial on page 9. (Cover illustration by Anthony Russo.)

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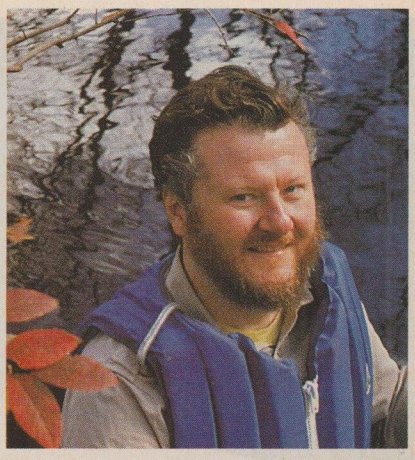
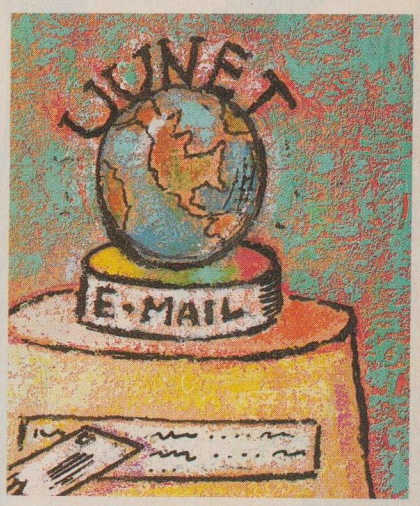


Top: *Few who see the tall, bearded warden at the Vale Reservation would suspect that Oliver Jones is a key member of the computing industry. Jones' book has helped demystify the X Window System for programmers. See page 43.* **Bottom:** *Services such as UUNET provide e-mail connectivity and user dialogue across the wires and around the world. Find out how to connect and participate, on page 64.*



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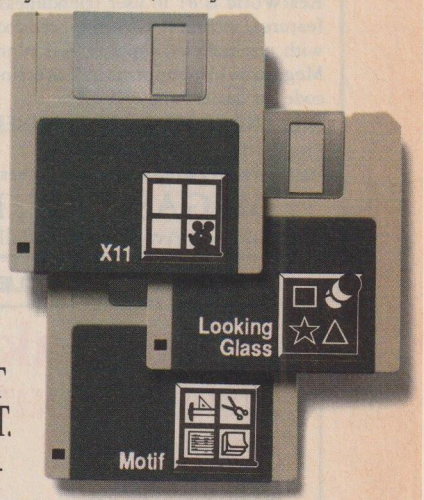

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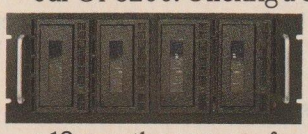

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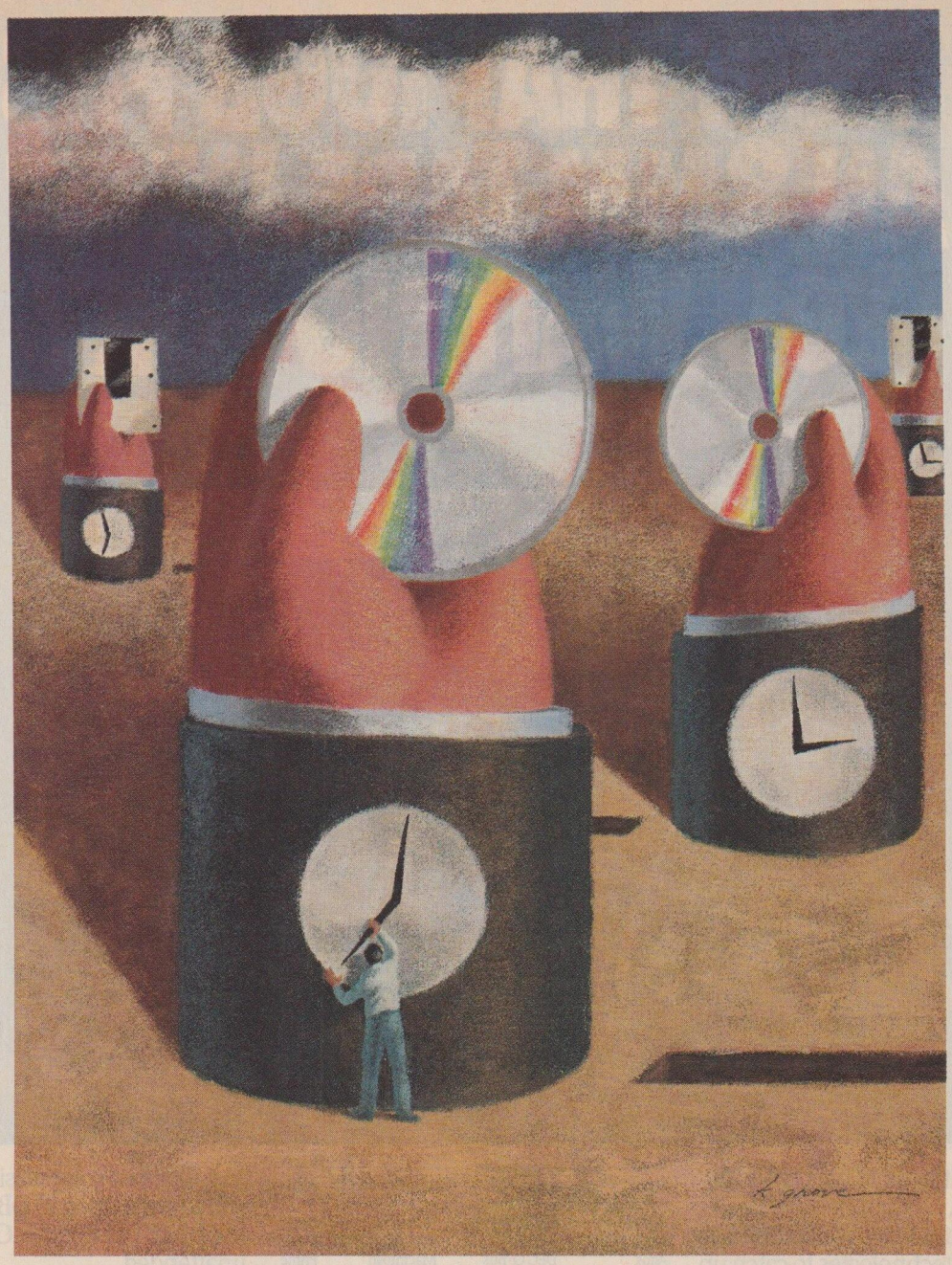

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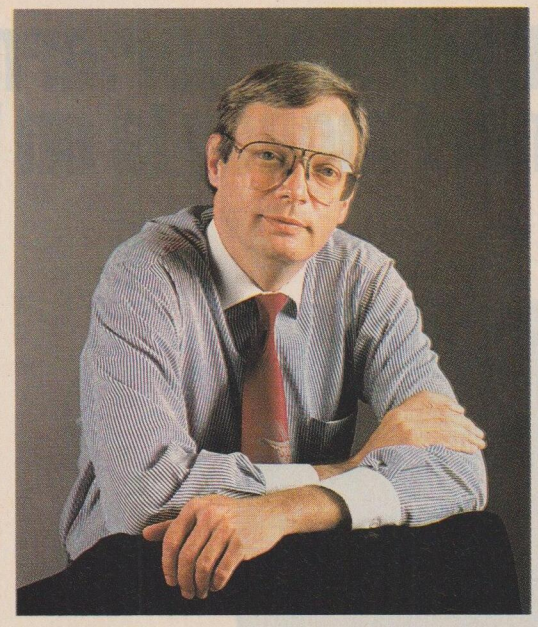


OPEN FOR DISCUSSION

This month's cover story asks the question, "What is Open Systems?" Alas, the answer is a cacophony of contradictions and confusion. Well, what do you expect when a term synonymous with goodness and light is left to those with vested interests to define?

At UNIXWORLD I bear the responsibility for definitions. Follow me, then, as I lead you down a merry path guaranteed to make you the envy of the next person who asks *you* for a definition of open systems.

Let's start with "What is a system?" It is usually software–often the "operating system"–though Sun Microsystems claims the SPARC processor is an open system. Also computer buses, such as the PC's ISA, EISA, and MCA buses, have been called open systems. Let's just agree that open systems are not limited to either software or hardware standards.

That was the easy part. Now we must decide what constitutes "open." Let's go back to the beginning of UNIX, where the ideas that lead to openness got their start.

One reason for creating an open operating system like UNIX was simple. The term is portability. If you wrote your software application for a closed operating system, one whose workings were kept closed and secret, your application could run only on the computer this operating system used. In other words, the closed operating system tied you to a single manufacturer's computer.

UNIX solved the portability problem because it was open to see how it worked with any computer and how applications worked with it. Programmers loved it because it is easier to move or port an application between any two versions of UNIX than any two closed operating systems.

UNIX was also open because it could be licensed to anyone who paid a reasonable price for it. UNIX source code was available.

Because UNIX could run on virtually any computer, from a PC to a Cray to an IBM mainframe, your application could run on a computer that was the right size for its needs. This ability is called scalability. Closed operating systems usually run on just one computer or architecture, though some scalability is possible by using multiple processors.

Finally, by combining UNIX with a public networking standard, such as TCP/IP, and Sun's Network File System, UNIX provided interoperability: the ability of networked computers to share files and applications.

So there you have it. Portability, availability, scalability, and interoperability–together they spell open.

But what if you don't have all four? Is a system like IBM's Systems Application Architecture (SAA) open if it provides interoperability to non-IBM machines? And if DEC makes VMS Posix-compliant, does portability make VMS an open operating system? Is an Apple Macintosh running a closed user interface on A/UX an open system? None of these systems can lay claim to all four criteria, yet each is more open than if it excluded them.

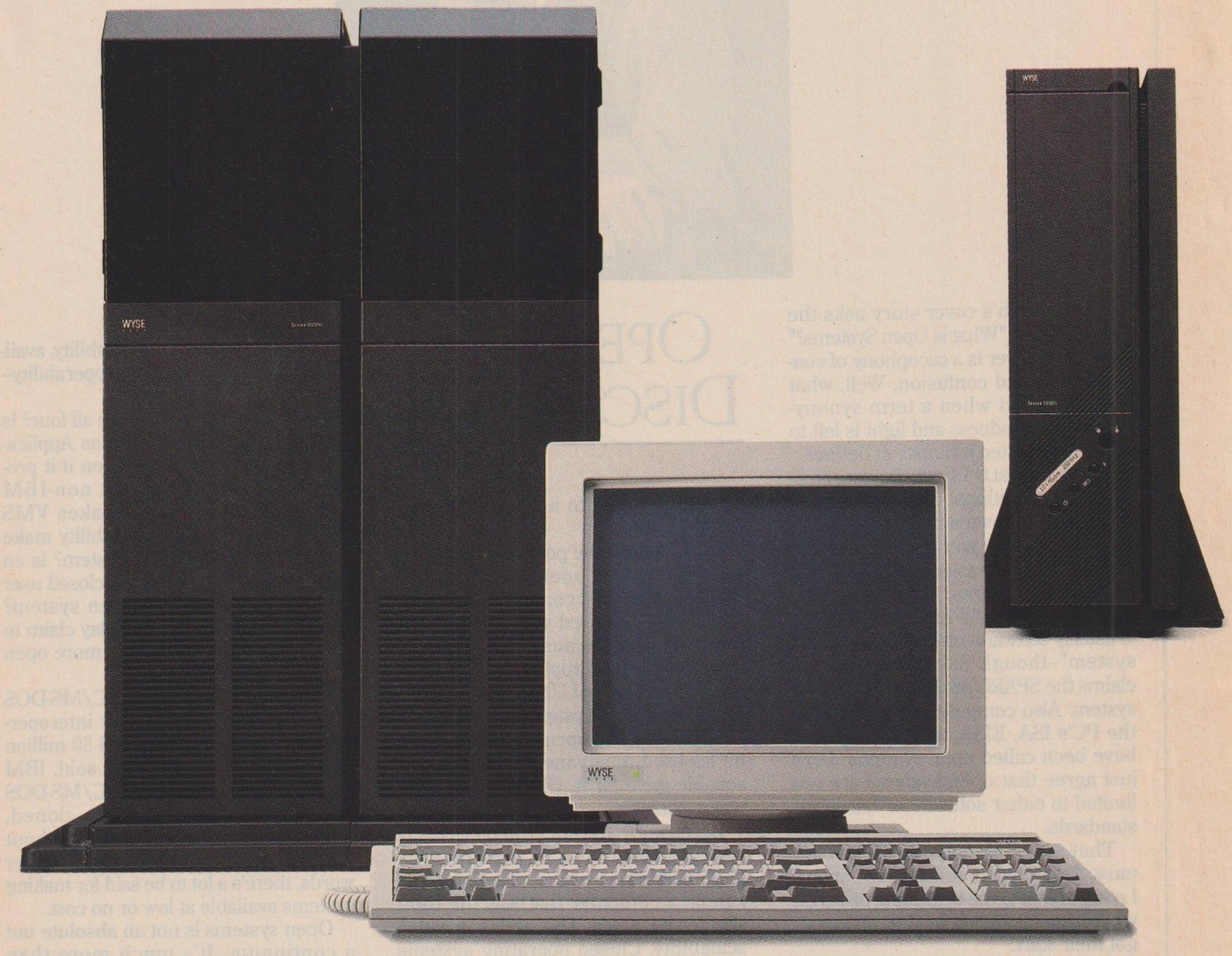
Here's another thought. PC/MS-DOS is not portable, scalable, or interoperable, but that hasn't stopped 50 million PCs and clones from being sold. IBM and Microsoft have allowed PC/MS-DOS and related hardware to be cloned, emulated, and otherwise sold without interfering with the process. In other words, there's a lot to be said for making systems available at low or no cost.

Open systems is not an absolute but a continuum. It's much more than UNIX. It is a number of ideas of how computer systems can better serve our needs.

We should not be surprised or upset that open systems is used to sell products, vanquish competitors, and convert the heathen. As Goethe's Faust observed, "When ideas fail, words come in very handy." ■

Dave Fiedler

In the UNIX multiuser performance race, the smart money is on Wyse.



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HP TARGETS THE MIDRANGE

Hewlett-Packard went through a long period of ineffectiveness in its minicomputer business, but it has started to turn the corner, say analysts. "HP's UNIX offering has become very strong," says Bob Herwick, an analyst with Hambrecht & Quist. "It offers a client-server model with a high degree of interactivity."

HP has updated its 3000 and 9000 lines with five new minicomputers and servers to better target commercial markets, especially the OLTP market, says Wim Roelandts, vice president and general manager of HP's Computer Systems Group. The new systems include the HP 9000 Models 842S, 852S, and 865S, and the HP 3000 Series 948 and 958. All are available immediately, except the Model 865S, which will ship in the second quarter of 1991. The new models range in price from $85,000 to $275,000. (HP has also announced seven new client-server software applications for the HP 3000 line.)

"If it can ship its products on time and fulfill its promises, then these two lines will continue to grow," says Tom Mancino, a consultant with Needham & Co. "HP's problems in the past have always been its tendency to be late with products, but this effort seems very solid."

SPEAKING MY LANGUAGE

Microsoft Corp. has increased its ownership in Natural Language Inc. with a $1 million investment in the private company, bringing its total ownership to more than 10%. Tania Amochaev, NLI president and CEO, says the investment is an "indicator of the growing interest in our technology."

NLI has raised $12.2 million in equity financing, including the investment from Microsoft. NLI develops and markets database tools that let users access relational database management systems in English. The tools run on all major UNIX computers, according to Amochaev.

Some analysts have doubts about the natural language market blossoming in the near future. "From an investment standpoint, the natural language market has a long way to go," says Bob Therrien, an analyst with Paine Webber in New York. "It needs more flexibility than just the ability to do queries."

Therrien, who follows Microsoft, says the $1 million is a "long-term investment" for Microsoft.

Microsoft and NLI have also announced that they are actively working to investigate the use of natural language technology in future versions of Microsoft's products. This doesn't imply that Microsoft is coming out with a relational database soon, say analysts.

"This is, essentially, a way for Microsoft to keep its hands in the tools business," says Paul Cubbage with Dataquest.

LET THE GAMES BEGIN

While programmers have been relaxing with games on UNIX workstations since the operating system was born, Dux Corp. (Los Altos, Calif.)–developers of Quintet integrated office software–has brought the Ishido game to the SPARC platform. Already available on the Macintosh and PC, Ishido, subtitled "The Way Of Stones," was named

as best strategy program by the Software Publishers' Association. The software is supposed to ship this quarter.

Dux President Bob Adams says this is just the beginning. "We've started the UNIX Entertainment Association," he says. Dux's alliance with Tiger Media may someday grow to the point when UNIX-based games are shipped on CD so that users can play with them. Users may then be able to call the developer to buy the password that lets them download it onto their system permanently. Adams says Ishido costs $99.99 for a single-user version and $79.99 for a five-user license.

TAKEOVER FEVER: IS INFORMIX NEXT?

Informix Software is becoming more attractive as a takeover target, says Allen Denison, a securities analyst with Black & Company. In a recent report he says Informix's earnings for the year could be a lowly $.60 per share. "In 1991, with only moderate success, earnings could easily go over $.90 per share."

At these prices, Informix would be "attractive as a takeover target," he says. Denison cites the recent example of Ingres, which was bought by Ask Computer for .67 times sales and about 1.4 times book value, which is roughly twice Informix's current valuation.

Denison says a takeover could help Informix. "Informix has a good product, but they have a hard time getting it out the door," he says. "A larger company with more distribution channels could help them."

EUROPEAN MARKET SLIPS

The American economic slump has had a rippling effect around the world, say analysts. "The [economic] slowdown in the United States and European companies betting on the opening of Eastern Europe have brought confusion into the European marketplace," says Paul Cubbage, an analyst with Dataquest. "Confusion brings a slowdown."

In fact, Olivetti, the Italian computer giant, is planning to eliminate 7,000 jobs because of this slump, according to the company. Losses and job cuts have also been announced at Philips N.V. of the Netherlands and Groupe Bull S.A. of France.

HUNTER TARGETS IN-HOUSE DEVELOPERS FOR UNIX TRANSFORMATIONS

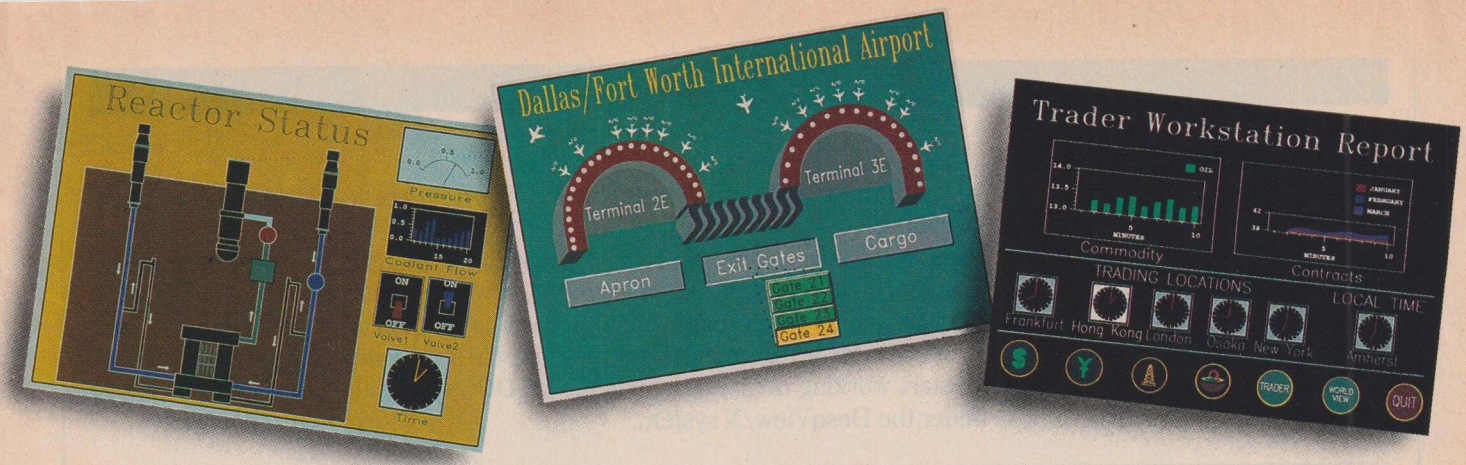
Hunter Systems' new XDOS Porting Service is a variation on its XDOS computer-aided porting system (CAPS), which lets developers translate their DOS software so that it can run on selected UNIX platforms. The new XDOS Porting Service targets in-house developers who want the DOS applications they've written to run under UNIX, but don't have any plans to sell them to end users.

To implement the service, Hunter Systems has set up deals with six contractors in the United States and Europe, with the possibility for another in Israel employing programmers who've emigrated from the Soviet Union, according to company president Colin Hunter.

The porting service costs between $50,000 and $100,000, depending on the complexity of the application. Running the software requires a network license fee. Hunter estimates the cost at about $100 per user, where a 10-user license fee can be bought if only 10 people at a time access the software. The new product will translate DOS software to UNIX for Intel-based PCs, the Sun-3, the NCR Tower, Motorola Delta, Arix, and Apollo machines.

QUARTERDECK UNVEILS X SERVER FOR DOS MACHINES

Quarterdeck Office Systems is planning an April release for its DesqView/X X Windows server software. By running the X server on a DOS machine, PC users can access



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CIRCLE NO. 57 ON INQUIRY CARD

X applications on workstations across the network, while workstation users can access DOS applications.

DesqView/X is based on Quarterdeck's DesqView DOS software, which lets multiple DOS applications run concurrently. DesqView/X will let users run DOS and X Windows-based programs "interchangeably," according to Quarterdeck's executive vice president of software development, Gary W. Pope. He also estimates that 50 to 60 developers will start working on porting X clients for DOS (particularly for later porting to UNIX) under the DesqView/X system.

DEJA VU ALL OVER AGAIN

Commodore promises to make its annual new product announcement at UniForum for the Amiga workstation running AT&T System V Release 4. Product Manager Jesse Bornfreund, recently brought on board from Rabbit Software, admits, "We figured it was time to put up or shut up." The machines were in beta release last summer. One site was Virginia Polytechnic, where computer science majors were allowed to run roughshod over it. Westinghouse was another site.

Anxious developers who wanted to upgrade from Amiga's DOS applications paid $5,000 for machines. Bornfreund reports "pilot sales"–placement in companies for testing, with potential for future volume sales–to Martin Marietta, NASA, and Rockwell. The machine will cost between $5,000 and $10,000, says Bornfreund. The 68030-based workstation (with a 68040-based version to come) will run SVR4 and the Motif graphical user interface.

EUROPEAN UNIX USERS GROUP CHANGES NAME

Reflecting a change in focus from UNIX in particular to open systems in general, the European UNIX Users Group (EUUG) has changed its name to EurOpen. The group has expanded its relationships with user groups Usenix and UniForum. It is planning its first joint exhibition with the latter in Amsterdam in 1992, according to spokesperson Donnalyn Frey.

The name change took place at a recent meeting in Nice, France, that was well-attended by both Eastern Europeans and Soviets, according to Frey. She adds that the Soviet Union has joined the new group. Participants at the meeting were especially interested in finding out how systems could be networked more efficiently.

DIGIBOARD TARGETS ISDN TO UNIX CONNECTIVITY

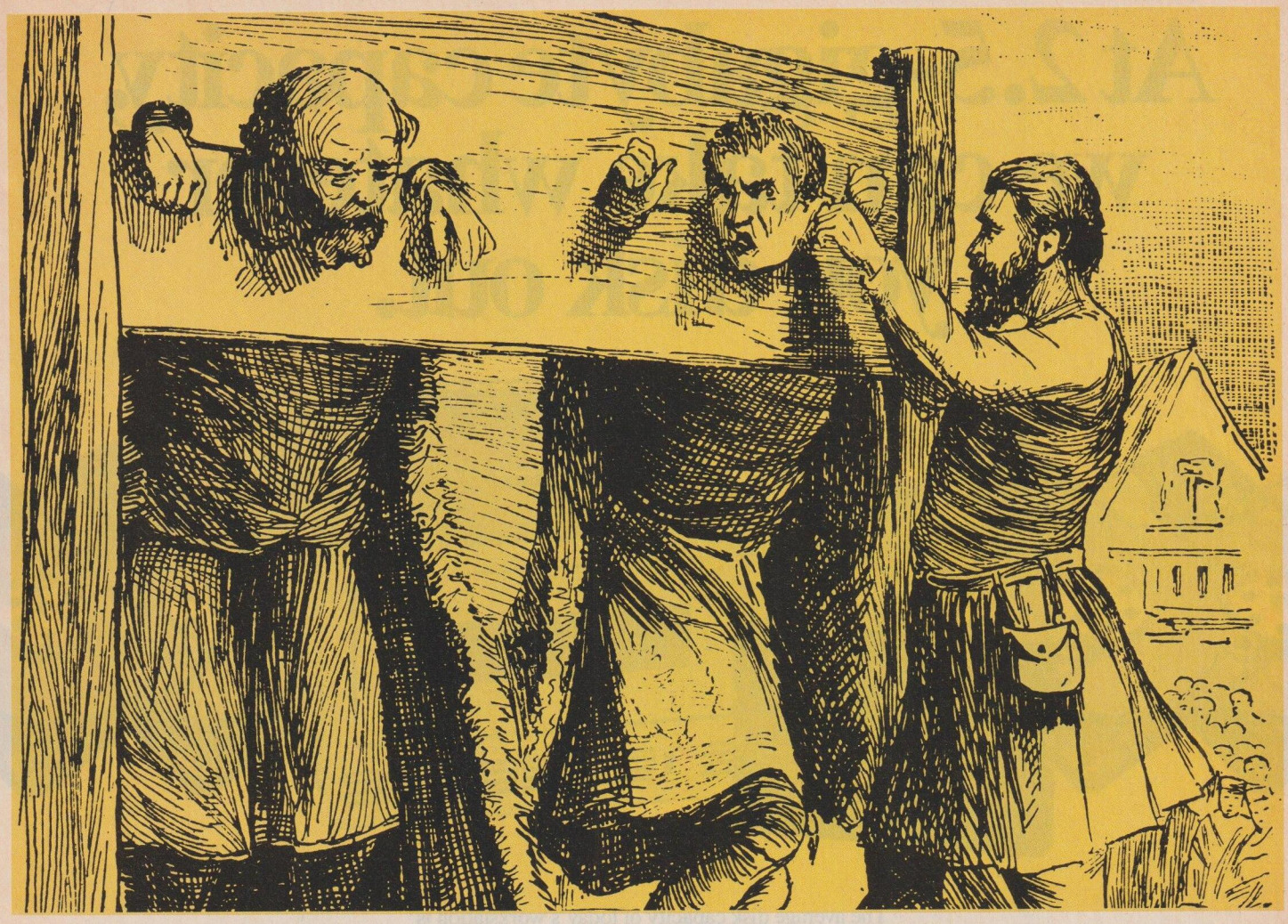
Multiport board manufacturer Digiboard is tackling the challenge of bringing ISDN (Integrated Services Digital Network) to UNIX-based terminals. It plans to bring a product to market during 1991.

According to H.A. Matthews, Digiboard's product manager for wide-area connectivity, the company has acquired an AT-bus-based ISDN board from Progressive Computing. Progressive considered going into the ISDN market but decided to concentrate on its core CPE (customer premises equipment) business.

Developers have key problems bringing ISDN to UNIX, says Matthews of Digiboard, especially with terminal-to-host connections. He emphasizes that replacing RS-232 with two 64-bit ISDN channels will be a significant challenge. The ultimate result, however, could mean video communications through character terminals.

SPARCS FLY AT COMDEX

There were SPARCs flying all over Las Vegas, with CompuAdd, Hyundai, Northgate, Twinhead, Fujitsu, Sampo, Trigem, and Goldstar Technology, among others, exhibiting



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Sun-compatible workstations during Fall Comdex.

Shipping, of course, is a different story. The SPARC-compatible from Tatung, for instance, will start shipping this quarter. DTK, on the other hand, introduced two SPARC compatibles, one using the traditional S-Bus and the other using the even more traditional VMEbus. The former is to be available this spring, and the latter is scheduled for summer.

Trigem's entry from Korea has a slick twist: it's a 16-mips laptop that's said to not only run SPARC applications, but Macintosh and DOS applications too. Weighing in at 13 1/2 pounds and named Brite Lite, the machine will be sold at a price targeted between $7,000 and $12,000 by RDI, a San Diego start-up firm.

SEQUOIA TAKES A HIT

Lower than expected revenue from Sequoia Systems Inc.'s principal distribution partner–the Ultimate Corp.–forced Sequoia to fall below revenue projections of $15 million for the second fiscal quarter of fiscal 1991 ending December 31, 1990, according to the company. While the revenue will probably be below analysts' estimates, it will be ahead of that for the comparable fiscal 1990 quarter. Sequoia is a manufacturer of fault-tolerant UNIX-based machines.

Tom Mancino, a consultant with Needham & Co., says Sequoia's problems have been caused by Ultimate Corp. The Ultimate Corp. has had poor sales in the eastern United States and internal financing problems. There has also been an ongoing internal conflict with the former CEO of Ultimate and the existing Ultimate management.

The shortfall sent profits for the quarters below estimates of $.14 to $.16 per share toward profits of $.11 per share for the comparable quarter of fiscal 1990.

UNISYS TARGETS KOREA

In an effort to build a stronger presence in the Pacific Rim, Unisys Corp. has signed a distribution agreement with Hyundai Electronics Industries Co., Ltd. Under the agreement, Hyundai will market, assemble, and package Unisys UNIX computers–U 6000/51, U 6000/55, and U 6000/60–at Hyundai's factory in Icheon. The systems will be sold under the Hyundai name as the Hyundai Super 6000 Series.

The new systems will target the expanding financial and insurance markets as well as the government sector, said M.K. Kim, Hyundai's vice president, information and communication service division, in a prepared statement. Kim cited surveys saying that the Korean market for small UNIX systems is growing from the 1989 level of $37.5 million to $97.5 million by 1993.

"This agreement gives us some crucial leverage in the Pacific Rim," says a Unisys spokesperson. Korea-based Hyundai has major manufacturing facilities and distribution and support channels throughout Korea, according to the spokesperson.

REAL TIME CONSORTIUM FORMED

A group of real-time software vendors and computer board makers has formed a consortium to promote high-performance, real-time computing standards. The group, the Real Time Consortium, was formed because of the need for portability between hardware and real-time operating systems. Users have found it difficult (and expensive) to achieve successful integration of real-time products with board-level computers.

Founding member companies include real-time operating system and kernel vendors Ready Systems, Wind River, Lynx Real-Time Systems, and Eyring Research Institute and high-performance computer board vendors Heurikon and Force Computers. For details, call 408-379-7434.

continued

INTERLEAF ON RS/6000

Interleaf and IBM have signed an agreement authorizing IBM to market Interleaf publishing software for the IBM RS/6000. Interleaf will set prices, terms, and conditions for its software under this Cooperative Software agreement.

TAPE STORAGE OF THE FUTURE

Exabyte president Peter Behrendt contends that, while current 8-mm tape technology gives users 10 gigabytes of storage per cartridge, by the turn of the century tape cartridges will be able to transmit 67 gigabytes at a rate of 6 megabytes per second. In the near future, Behrendt promises a half-height 8-mm tape drive, created in a joint program between Exabyte and Sony. This drive will appear in the second half of this year, he says.

Product enhancements for the company's 8-mm tape drives include data compression using IBM's IDRC (improved data recognition compression) algorithm for at least a doubling of capacity, and a desktop subsystem that will offer random as well as sequential access (due this summer).

AMD CHIPS AWAY AT FDDI

Advanced Micro Devices is shipping the second generation of its FDDI Supernet chip set this month. While previous generations required a full AT-bus slot, the Supernet 2 chip set has been implemented on a half-size board. AMD estimates that integration on the smaller board will cut $1,000 from the end-user price of a node attached to an FDDI network.

OVERHEARD

Sun CEO Scott McNealy on the success of the Unisys merger: "Burroughs and Sperry have proved the power of two–that's their stock price right now."

"When he first started using UNIX, he felt like he was bothering it."—Don McGovern, with AT&T's UNIX Software Laboratory, quoting an Apple engineer.

"Either there's a great interest in UNIX on the desktop, or you're all tired of walking the aisles."—Curt Fisher, at the Sun Microsystems booth at Fall Comdex.

"The best strategy for UNIX is to skip the desktop. There's going to be a shakeout in laptops. UNIX should go straight for the palmtop. That's where the gravy is. After all, everybody has two of them."—Portia Isaakson, research analyst, BIS CAP.

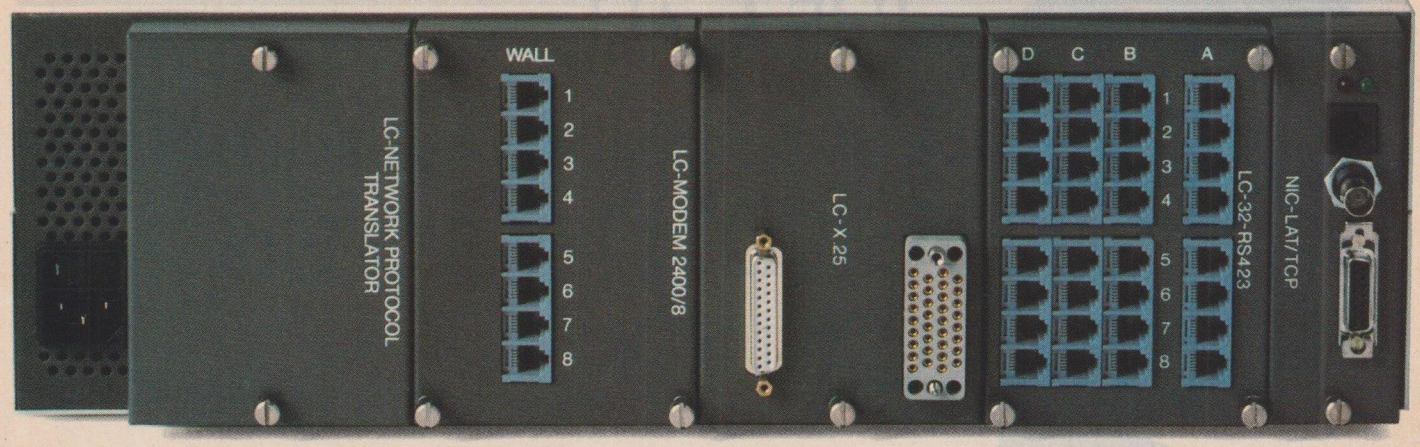
"Comdex should have noise abatement procedures."—Bob McDonald, executive director, Strategic Marketing, Informix Software.

After hearing a particularly passionate proponent at the "UNIX on the Desktop" panel at Fall Comdex, an attendee remarked: "If they have to sell it this hard, there's got to be something wrong with it."

Analyst Richard Shaffer at his recent "PC Outlook" conference, questioning the logic regarding the AT&T-NCR proposed merger, told AT&T's Bob Kavner: "You could've bought most of the companies in this room, plus Sun, Compaq, and Apple, for $6 billion." ■

—Edited by Gary Andrew Poole with staff reports. Please send any breaking news or comments to him at: `uunet!uworld!garyp`.

Five Easy Pieces.



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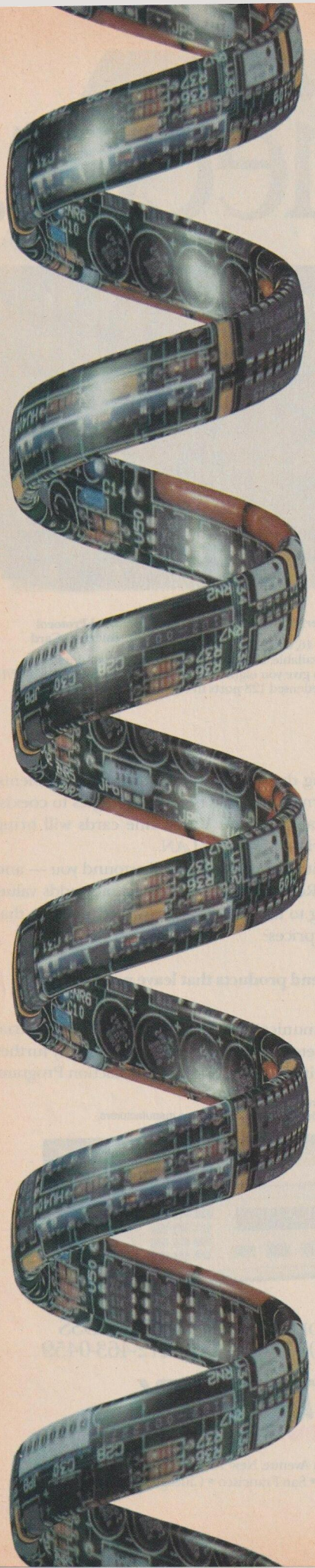

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CIRCLE NO. 119 ON INQUIRY CARD

EARTH CALLING UNIXWORLD

Dear Editor:

Congratulations to Anke Goos ("Is Plan 9 Sci-Fi or UNIX for the Future?", October 1990) for surely the most ironical statement of the year: "Plan 9 is not typical UNIX, but a system designed by software developers for programmers". Ha, ha, ha, ha, ha. How about another try? Who was it that said "those who forget history are slaves to it"?

David K. Walker
Tertnes, Norway

Editor's reply: Unfortunately, this statement appeared as an editing error, and should not be attributed to Ms. Goos.

Tektronix Omitted from X Terminal Test

Dear Editor:

Your October 1990 issue has extensive X terminal coverage. In all the seven-plus pages on "Buying the Right X Terminal," you failed to mention the TekXpress X terminal family about which International Data Corp.'s terminal specialist Eileen O'Brien says, "Tektronix has truly launched a new product line that others will surely try to follow..."

Even tougher to comprehend is the conspicuous absence of this highly touted, hot-selling new product entry from a buyer's guide appearing in an influential, industry-savvy publication. We do not see how you can plead ignorance of our X terminal products.

We have reviewed the criteria you listed in "Buying the Right X Terminal." Here is our analysis. You said, "We based our nine selections on company reputation." Tektronix pioneered the graphics terminal market. You said it must drive standards-setting at the MIT X Consortium level and be unique. Tektronix offers a three-year warranty and innovative ergonomic design. You also wanted the company to supply you with a monochrome or grayscale unit with a 14- to 17-inch monitor, and our XP23 grayscale model features a 19-inch monitor.

All things being equal, monitor size would have disqualified us if you had adhered to tight review parameters. But, you did not, not by a long shot. Here is another quote from the article: "As it turned out, not all vendors complied with the criteria. Two submitted color units, Hewlett-Packard sent along both a color and a 19-inch monochrome unit, and even HDS foiled us with a 19-inch monochrome unit. Yet another, Datacube, submitted a color version with our permission."

It is difficult to fathom how any thoughtful, prospective X terminal buyer could take seriously the results of an incomplete review process like this. With this major article, the results of months of work, UNIXWORLD had the opportunity to shed considerable light on a burgeoning and often confusing product category. This has added to the confusion.

We strongly suggest that you take another look at X terminal contenders, and, in fairness, hold to your selection and review criteria. It is the only way to provide a genuine service to your readers.

Pat Welch
General Manager
Network Displays Division
Tektronix
Wilsonville, Ore.

Product Reviews Editor Alan Southerton replies: You're right, we made a mistake. We should not have allowed vendors to deviate from our criteria. I personally want to thank Tektronix for observing our criteria and not submitting a nonconforming system. Unfortunately, your ethics go unrewarded in this case.

The editorial process requires integrity on the part of reviewers and benchmarking organizations, as well as vendors. You can be sure that our next X terminal roundup will feature color systems, and Tektronix will be a candidate for inclusion.

Setting the Record Straight

Dear Editor:

I was pleased to see your positive review of our Microsoft Windows-based X server, XVision, in the November 1990 issue of UNIXWORLD. There was, however, a serious mistake within the article concerning XVision's ability to use Microsoft Windows 3.0 386 Enhanced Mode. Your reviewer said, "Doesn't support enhanced mode in 386..."

Users familiar with X will know that any display server has a high requirement for memory. The release of Windows 3.0, with its improved memory management, has had a significant impact on the performance of Microsoft Windows-based applications, especially XVision. VisionWare took full advantage of this by releasing a Windows 3.0 version of XVision in April 1990, which can run in real, standard, or 386 Enchanced Mode. Your reviewer had a PC with 32 megabytes of memory, and Windows can only offer enhanced mode on PCs with up to 16 megabytes of RAM.

Many potential customers called us to express their concern about your comment, and an existing customer faxed us to say, "I've been running XVision in enhanced mode for months, and it works fine. Yours is the best product of its kind, and I would hate to see you lose business as a result of this error..." So would we! I hope the record is now straight.

Nicola Richardson
Marketing Manager
VisionWare Ltd.
Leeds, England

Product Reviews Editor Alan Southerton replies: Thanks for the correction. Who would have ever thought you could have too much memory!

Of Vanilla Kernels in Real Time

Dear Editor:

As a user of a UNIX system with real-time extensions, I enjoyed the November 1990 article, "Making UNIX Predictable." However, I must take issue with the statement that "The major weakness of vanilla UNIX for real-time applications is the lack of a pre-emptive kernel...."

The vanilla UNIX kernel is pre-emptive for user processes, but it does so on a time-slicing basis that attempts to be fair to all interactive processes, favoring those with light CPU usage. A process doing a system call which switches to "kernel mode" can avoid pre-emption until it blocks or the call returns to user mode. In practice, this does not usually result in lack of pre-emption. A non-preemptive multitasking system like Microsoft Windows depends on processes voluntarily giving up control, usually by checking for system messages. A CPU-intensive process in vanilla UNIX steadily

loses priority, ensuring that other interactive processes are not "locked out."

This leads to the article's "space shuttle" problem. How do you make sure that your navigation control program performs its job exactly 25 times per second? As the article mentions, a number of companies have provided extensions or modifications to the UNIX kernel to provide these real-time capabilities.

I am surprised that you failed to mention Hewlett-Packard. It has supported real-time features in its HP-UX System V-compatible operating system since 1986. In addition to essential priority-based pre-emptive scheduling, HP (among others) provides other features, which you did not mention, that are important for predictable response time, including process memory locking, fine timer resolution and time-scheduling capabilities, kernel mode pre-emption, pre-allocation of disk space, and privilege mechanisms.

All of these features are tools which make real-time programming possible. But, to provide predictability, it is also essential to program with disciplined use of other "standard" UNIX programming facilities such as interprocess communication, forking, opens, locking, file system vs. raw I/O, and others. I look forward to more articles about using UNIX for real-time applications.

Mark Rosenthal
Louisville, Colo.

IBM Responds to RS/6000 Review

Dear Editor:

A customer's workload is the ultimate benchmark. IBM's experiences with real customer applications benchmarked on the RISC System/6000 have shown strong integer and floating-point performance, whether the system is used as a workstation, multiuser system, or server. This performance is one of the key reasons that customers are buying it.

The UNIXWORLD/Neal Nelson & Associates benchmark results mentioned in your September 1990 "Industry News" item, "Big Blue's RS/6000 Isn't White Lightning," are inconsistent with what we have seen. Since the test suite is proprietary, we are unable to directly comment as to why the differences may have occurred. We surmise that the benchmarks based on UNIX commands and functions may not depict the kind of operating environment that most of our customers have. In UNIXWORLD's own detailed benchmark description, which it makes available upon request, it is acknowledged that very few users spend all their time running only UNIX commands. We encourage customers to obtain this description to determine whether the benchmark accurately represents their environment.

John D. Wetmore
Personal Systems Director
Advanced Workstations Marketing
IBM Corp.
Somers, N.Y.

Editor's reply: The UNIXWORLD/Neal Nelson Benchmark–not only the UNIX-

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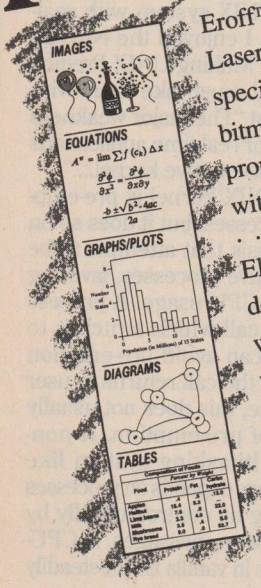

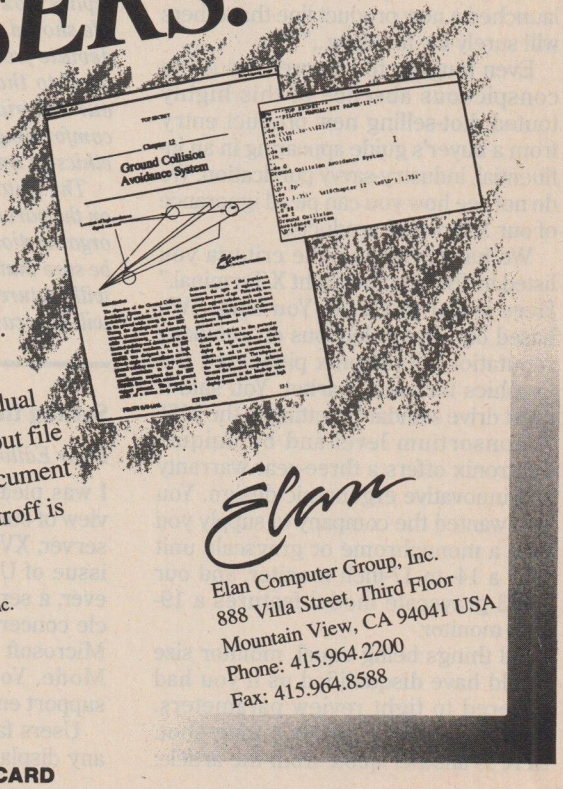

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WORLD script, but the benchmark's source code–is available to IBM or any other organization to examine, criticize, or duplicate our tests.

Hyping Hypertext

Dear Editor:

I read with interest "The Age of Hypertext" in your November 1990 issue. I am currently working for a large oil company, converting an on-line handbook on VM/CMS into hypertext on UNIX (on Suns).

I was surprised that you did not mention the hypertext software that I am using for this task: hyperCmedia, from Paradise Software (609-397-4142, Lambertville, N.J.). This software has worked very satisfactorily for this application–currently the handbook has 928 media pages, some monochrome raster images, and the rest is text. HyperCmedia can also handle color raster images and has audio and video capabilities, although I have not used these in the particular application I am using. And the "C" in hyperCmedia is because the resulting documents are displayed using C language programs.

I thought your readers who are interested in hypertext on UNIX may want to check out this product.

Sharon Tuttle
Houston, Tex.

Clarifications

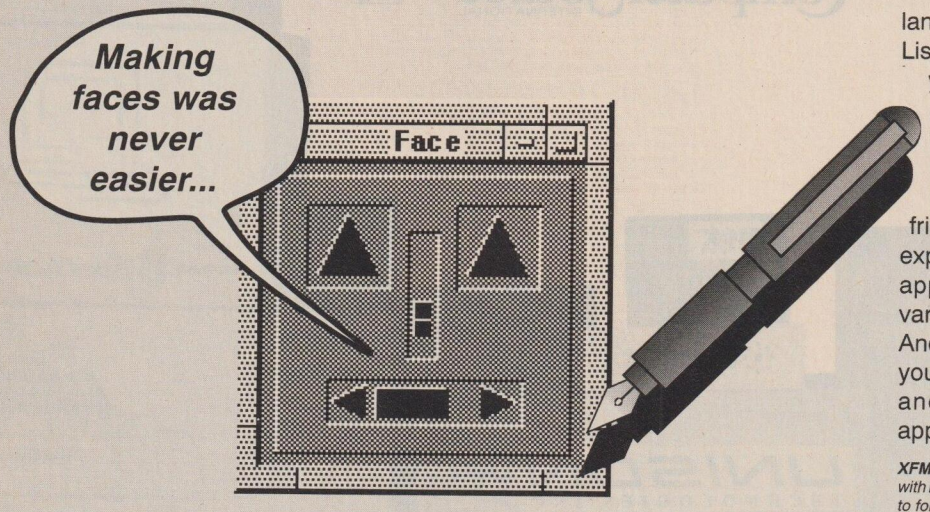
In our November review of IBM's RS/6000 workstation, the word "shipping" was dropped from the number of applications available for the machine. We said the number was "more than 150." IBM says that as of December 1990, the shipping number of software applications is now 1,500. We also wrote that the number of porting centers was six. IBM reports that 15 opened at first, and the number is now 46.

Correction

In the December 1990 article, "Getting Rid of Old Computers," the toll-free telephone number for National Computer Exchange was incorrect. The correct number is 800-359-2468. The editors regret the error.

UNIXWORLD welcomes letters to the editor because your opinion matters to us. If you would like to comment on past articles or just voice your opinion on an issue, either write to us at 444 Castro St., Mountain View, CA 94041, or send us e-mail at the following address: `uunet!uworld!letters`.

All letters must include an address, and daytime and evening telephone numbers. Postal letters must be signed. We reserve the right to edit letters for clarity and space. ■



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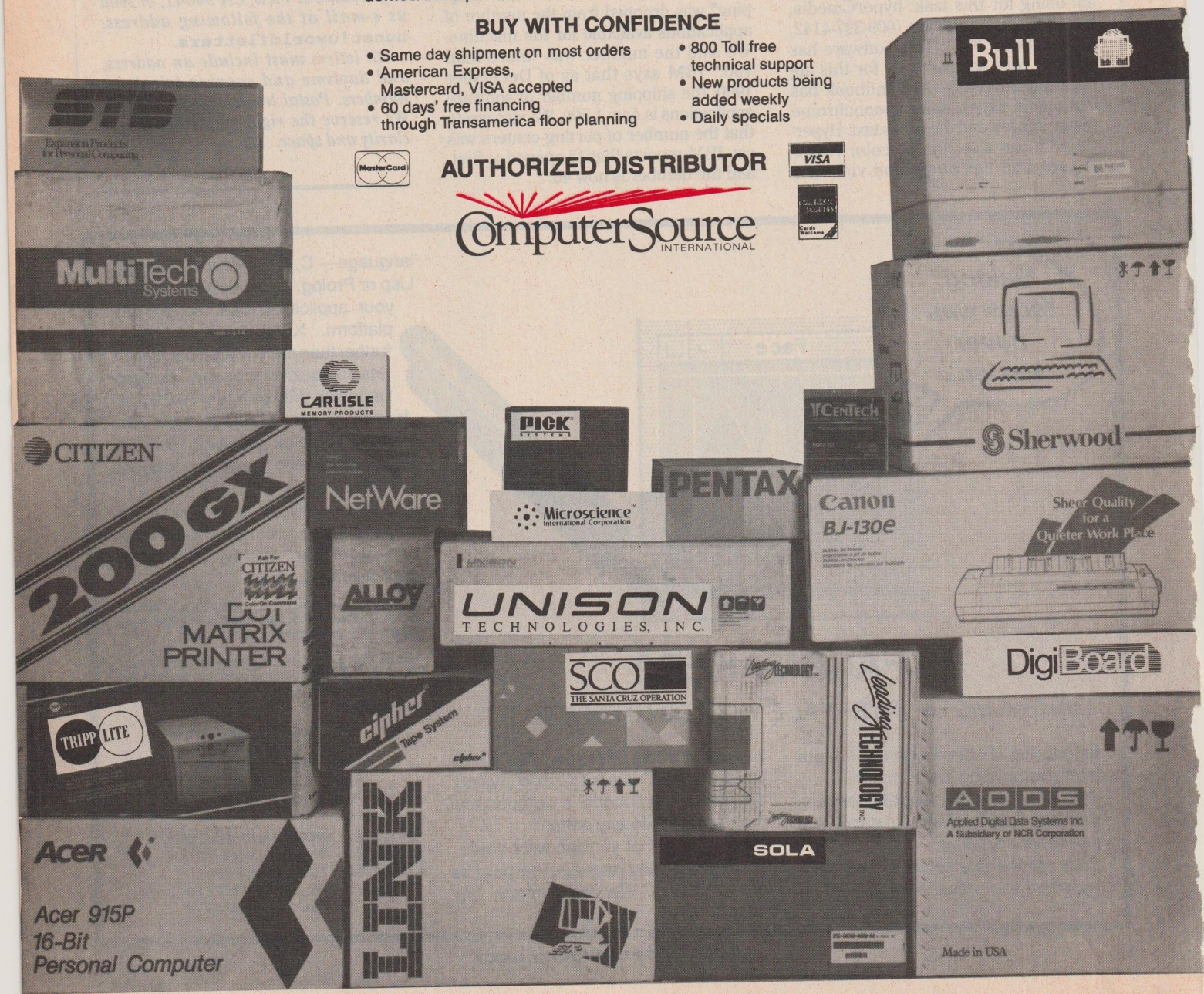

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Howard Baldwin

APPLIX REWRITES THE RULES OF INTEGRATED OFFICE SOFTWARE

Most integrated office software systems deliver a nice, neat package, wrapping up traditional desktop applications like word processing, spreadsheet, calendar, mail, and notepad, with consistency among the function keys. With some IOS systems, you can integrate a limited number of other packages; Uniplex, the leading UNIX IOS, lets you work with the Informix database and Fourgen accounting software, along with its other desktop functions.

Applix has turned the tables on this concept of integration. Asterix, its new X Windows-based document software, combines the functionality of traditional word processing and graphics applications, with a flexibility that lets you choose what other software you want to integrate into your own IOS system. In a model of software selflessness, you can even remap function keys so that Asterix's commands match the commands of the software you bring in; you aren't tied to its view of the keyboard. Whether you're a value-added reseller (VAR), original equipment manufacturer, or systems administrator working with a large number of workstation and X-terminal users, Asterix represents a new level of expandability.

At its foundation, Asterix has the basics of integrated office software. Asterix Words is word processing software with WYSIWYG display capabilities. A graphical ruler lets you point and click to change margins, tabs, or page justification. There's a default styleguide, or you can create your own.

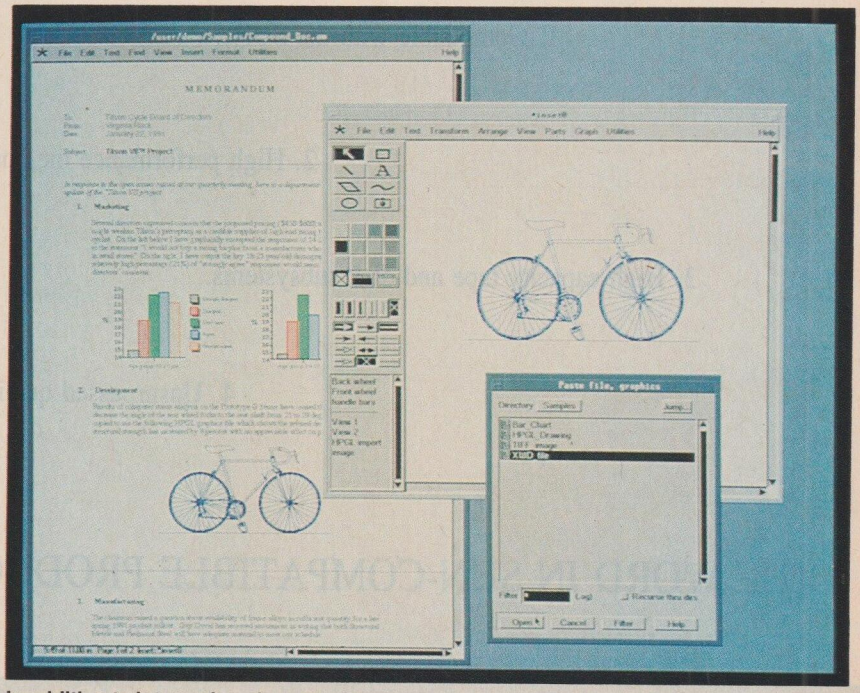
But Words also gives you the capability to merge elements in the system to create compound documents. By automatically linking elements, you can integrate text, graphics, and spreadsheets into a single document. When information is updated in one file, the changes appear in the appropriate combined document. Go one step further and merge multiple documents. The software automatically builds the table of contents and the index, and ensures that the section and page numbering is consistent.

Words uses Adobe PostScript typefaces so you can alter typefaces and type sizes as necessary. Besides the requisite dictionary, spell checker, and thesaurus, Words lets you "redline" documents by noting additions to and deletions from preceding versions. You can cut and paste from other X applications, and wrap text around graphics.

Words can convert other documents into the Words format with an importing and mark-up language, a feature that's also part of Asterix Graphics, the graphics module of the product. You can import existing images done in HPGL (Hewlett-Packard graphics language), TIFF (tagged-image file format), and EPSI (encapsulated PostScript interchange) into a graphics document, or create your own using various drawing tools included in the package. The same cut-and-paste actions apply to graphics as with text, and editing can be done on a pixel-by-pixel basis, if necessary. The resulting graphics can be duplicated, scaled, and rotated.

Asterix also has an X Windows-based spreadsheet, but it's optional at $495. Like QSP's Exclaim or Informix's Wingz, it provides maximum flexibility in terms of graph styles, multiple views of the spreadsheet, annotation of data, and the ability to link different spreadsheets to each other. The spreadsheet also links to the Words and Graphics modules.

Those aren't the most important aspects of Asterix, though–that's just its foundation. Especially important if you're a VAR is its Macros function. A macro is just a collection of keystrokes that makes requesting a function easier, but in Asterix, the capability goes further. You can modify not only the Asterix



In addition to integrating elements from different modules into a single document, Asterix allows customized function keys and more software choices.

interface but also the individual key assignments to accommodate whatever preferences you or your users might have.

This lets you do a complete flip-flop–to your advantage–on the logic of an IOS. An IOS is efficient for the user because the same keys produce the same commands in different modules of the software. F1 brings up a help screen, whether you're doing word processing or spreadsheet calculations. This consistency lets users move from module to module with greater ease. Asterix's macro allows customization of its IOS modules to match whatever commands you already have. Users don't have to learn a new set of commands.

Besides creating combined and specialized commands within the Macros module, you can also call upon ELF (extension language facility). ELF takes the macro concept and, as a procedural programming language, uses it to create reports at a time interval of your choosing, or to link to a database, or call up other X-based applications. For instance, you could have Crosswind Technologies' Synchronize group scheduling software on the system, and set up a macro so that users could access it from the Asterix interface. The advantage: you don't have to toss out the mail or scheduling software your users are accustomed to, nor do you need to worry about integrating other software packages in the future.

Asterix's macro allows customization of its IOS modules to match commands you already have

Other features of the software include on-line tutorials, context-sensitive help screens, and a documentation library. Asterix is available initially on SPARC-based workstations using SunOS 4.0.3 (or later), and DECstations using Ultrix 3.1 (or later), running under both Motif and Open Look. Cost is $695 for Words, Graphics, and Macros together. If the spreadsheet module is purchased at the same time, the price is $995. Network site licensing is also available.

While you could obtain all the elements of Asterix in other products, you'd probably end up with an unwieldy collection of document publishing, graphics, spreadsheet, and word processing software. Asterix not only puts all the salient features of integrated office software in one place, it lets you mix and match as you please. It brings one step closer the day when software will be judged not by what hardware it runs on, but by what other software it runs with. **Applix, 112 Turnpike Rd., Westboro, MA 01581; 508-870-0300.**

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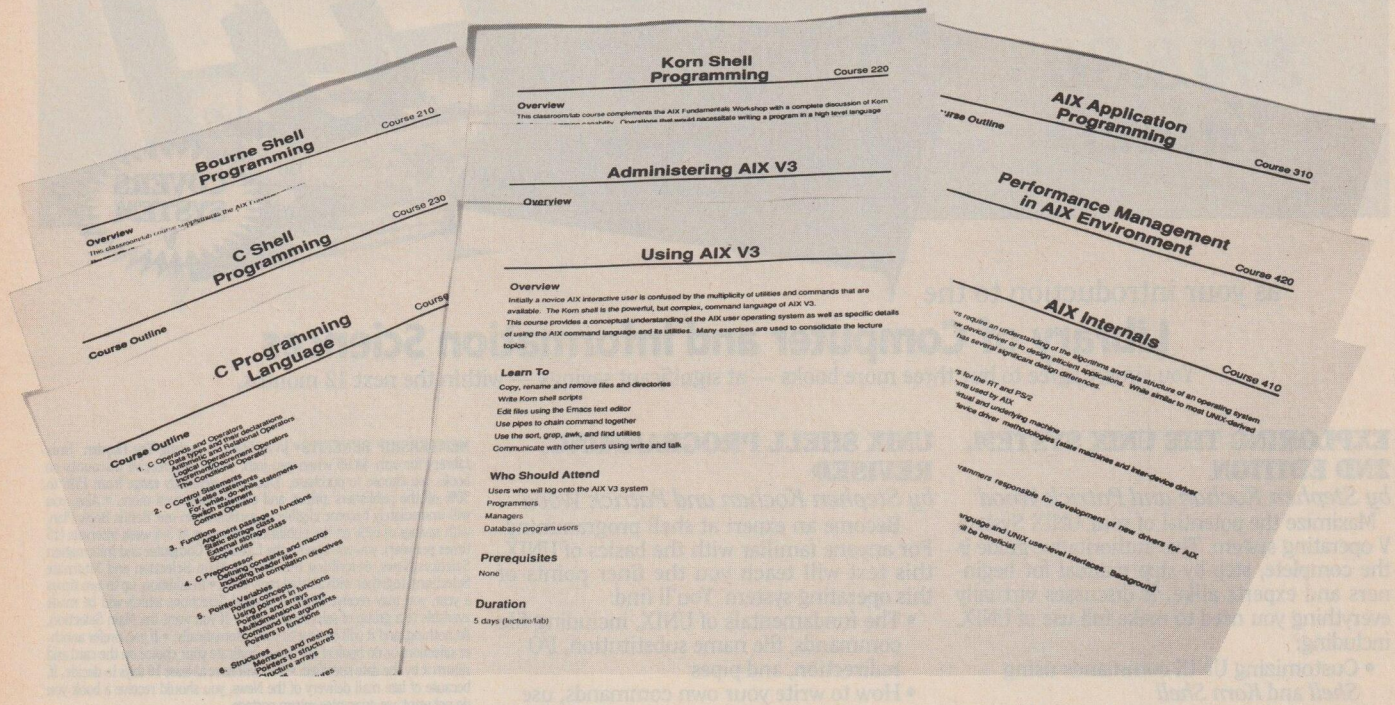

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Reviewed by Walter Zintz

BEGINNING HELP AND HELPFUL REMINDERS

Leading off this month are two introductory UNIX books for very different classes of beginners: those seeking an easy-going introduction to UNIX and those who want to get into much more detail. For readers looking for a few reminders on technical topics, I've also reviewed pocket-sized, quick-reference publications on System V Release 4 and RS-232.

THE FIRST BOOK OF UNIX

By Douglas Topham
Howard W. Sams; 317-298-5709
288 pages; 16 pages of Index & Contents
ISBN 0-672-27299-7 paperbound; $14.95

Topham has chosen to mix two of the common styles of introductory computer books. While his manner is easy-going, even hand-holding, the serious content and pace are for readers interested in getting more detail on UNIX commands.

A typical chapter begins with a summary of topics the chapter will cover. It ends with a review summary and an extensive quiz. Answers to all quiz questions are found at the back of the book.

In the core of each chapter are study aids galore. Most pages have at least one example of what you should type in a particular situation and the response you can expect from the system. Diagrams and tables appear frequently. Almost as frequent are short bursts of advice, warning, or guidance. These are highlighted within color blocks even more intense than the ones used as background for diagrams and other figures.

For still more help there are other features at the front and back of the book. A quick-reference section summarizes many of the utilities the book covers. This section is indexed only by command names, but the book's inside front cover lists those commands alphabetically with a very short description of each command's general function. An extensive glossary rounds out the book.

Topham's writing style is his transition from easy-going to hard-driving. His style is to say something once, usually rather clearly, and then drop the matter to go on to other things. The quizzes, while not tricky, do demand that the reader remember numerous details without having them repeated. This fast pace leads to a surprisingly high information content. By the end of the book, a careful reader will know how to make good use of about half the UNIX utilities a non-technical user commonly uses. That's a lot for a beginner's book that you can easily hold with a thumb and one finger.

This book is oriented toward System V users, although it has a short section on the C shell. The information in it is pointed toward lay end users rather than programmers or system administrators. But the raw beginner who intends to become a programmer or administrator some day might find this a good entry point.

Review Highlights

Technical Level: Beginner
Understandability: Lucid
Summary: For beginners who want clarity combined with pace.

USING UNIX SYSTEM V RELEASE 3

By Geoffrey T. LeBlond, Sheila R. Blust, and Wes Modes
Osborne/McGraw-Hill; 800-227-0900, 415-548-2805
490 pages; 27 pages of Index & Contents
ISBN 0-07-881556-8 paperbound; $27.95

Why an SVR3 book now, when SVR4 is already released? Probably because SVR4 doesn't look likely to knock SVR3 off the market any time soon. Perhaps it's the vast difference between those two releases, making it the devil's own job to reverse-engineer SVR3 usage techniques from a book about SVR4. In any event, the authors have stuck closely to the version in their title. The only significant exception is an occasional short digression into Berkeley UNIX.

There are several schools of thought on writing a beginning UNIX book these days. The authors of this one have chosen one of the standards. They start at the beginning, assuming not even computer literacy, but go on to lead their persistent readers well into the intermediate-user level. Their tools for this job are the customary ones. The authors use extensive explanatory text, lots of examples, a little advice from time to time, and plenty of pages. The topics chosen point the book toward office users, particularly documentation people, but there is a noticeable amount of help for programmers.

The text itself is no better than average for a book aimed at this market. One problem is an occasional explanation that's too muddled to be readable. As one example, the aspiring **troff**er wanting to learn what fill mode is about is told, "When it is in fill mode, the formatter scrunches all the input lines together in the output." This sentence brings several possibilities to mind. None of them remotely resembles what fill mode really does.

A bigger drag on the reader are the persistent errors and half-truths. Almost every book I review has some errors in it, but they aren't usually as frequent or as obvious as here. Take the nearly-full-page illustration in the **vi** chapter that shows a screen of text before and again after a CTRL-D command. It's incorrect that the "before" screen has the cursor in two places and the "after" screen has no cursor at all. And anyone who uses **vi** regularly would know that CTRL-D does not rearrange linebreaks, as this illustration shows them.

It's the last third of this book that makes it worth space on bookstore shelves. This is a reference section–what I regard as **man** pages for ordinary

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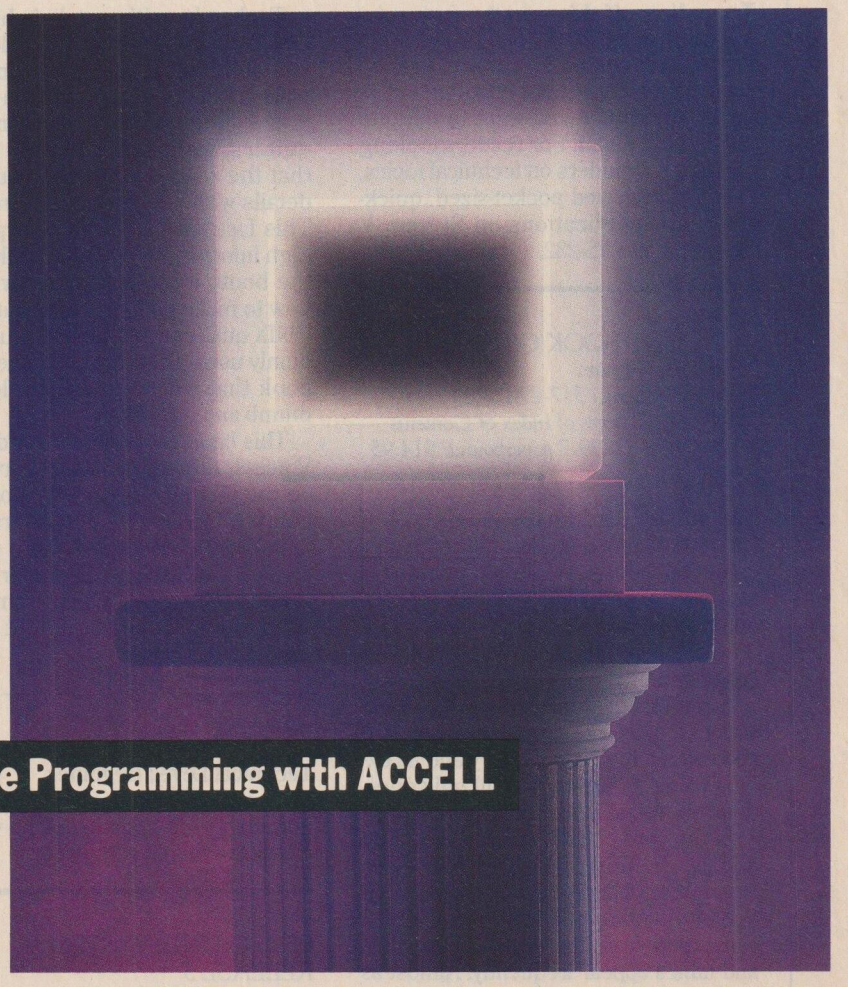

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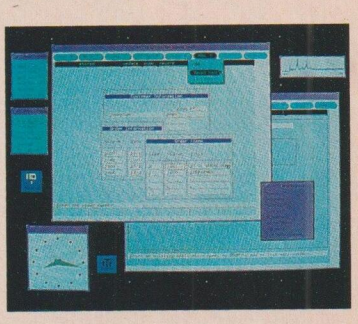

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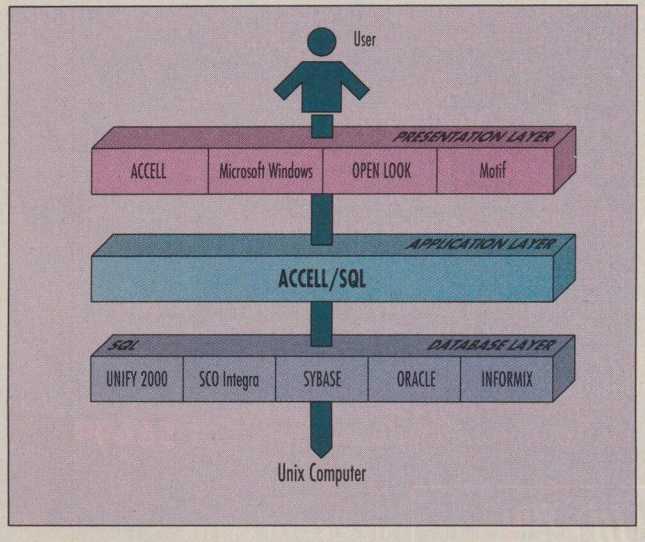

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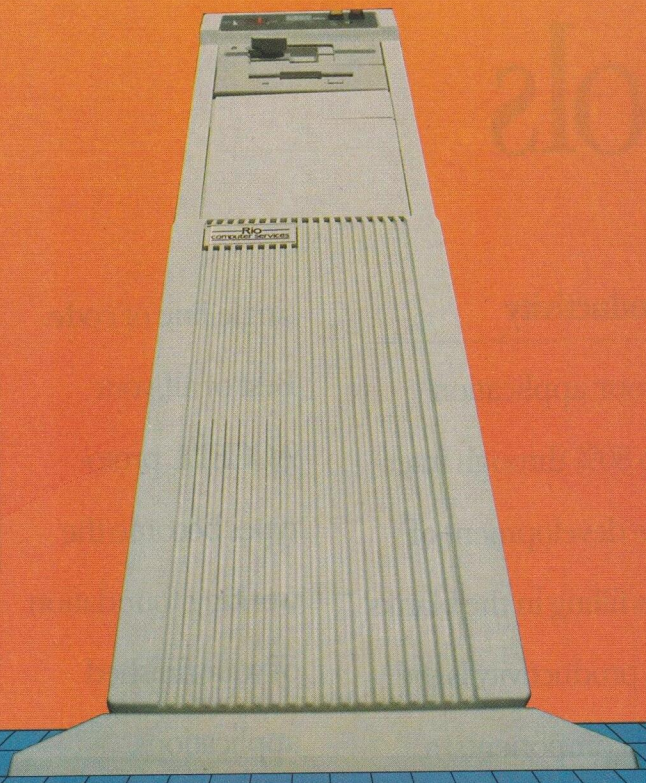

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CIRCLE NO. 117 ON INQUIRY CARD

humans. Close to 100 commands are listed alphabetically by command name. For those who know what they want to do, but not the name of the command that does it, there's a short list of commands classified by topic. There's also a short summary of each to further help pick out the right one. Then it's on to the command's listing, where function, syntax, options, arguments, and even incidentals are all nicely laid out and clearly summarized.

Review Highlights
Technical Level: Beginner to Intermediate
Understandability: Almost Lucid
Summary: A passable textbook and a very good quick-reference for SVR3.

UNIX SYSTEM V.4
COMMAND SUMMARY
Specialized Systems Consultants;
206-527-3385
80 pages; 1 page of Index & Contents
ISBN 0-916151-44-1 paperbound; $8.00

Doing anything with this pocket quick-reference requires knowing the name of the command you want to use, for starters. Everything's listed under the names of the hundreds of commands covered here. There is no cross-referencing, by topic or otherwise.

Then you'd best be an ordinary system user. This booklet covers very few administrative or graphics commands and no commands restricted to the superuser.

That said, there's a vast amount of information here. For every command covered, this booklet tersely tells you most of what you'll need to know about invoking it from your shell prompt. That includes myriad options and arguments plus their defaults.

When a command is interactive or uses command scripts, help is less certain. Some subcommand systems carry in-depth summaries. There are several pages each on the Bourne shell and **awk/nawk**. Shorter, but still substantial, coverage is given to other commands of this type, such as **ftp**, **telnet**, **ed**, **sed**, and **sdb**. Under **cu**, this booklet at least tells you how to display the on-line list of interactive commands.

But there is no interactive-command help at all for **more**, **cscope**, **vi**, and others. Skipping the interactive aspects of **vi** is the worst offense. This editor is absolutely useless without a knowledge of its internal command structure, and there is no on-line command summary for either of its modes. It's the least excusable offense, too. This booklet gives four of **vi**'s aliases as separate commands, each listing discussing the same command-line options. The wasted space would have been ample for a summary of internal **vi** commands.

Organization within the listings is basically sound. A lot of information is encoded in symbols and changes of typeface, both thoroughly explained at the front of the book. Options are listed alphabetically by option flag. And for those who want really quick reference, the front and back covers

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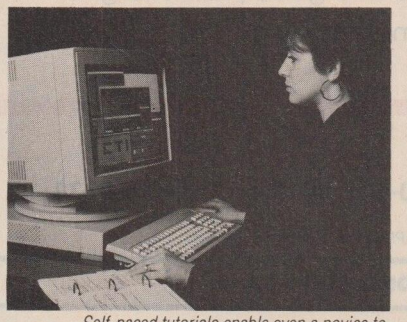

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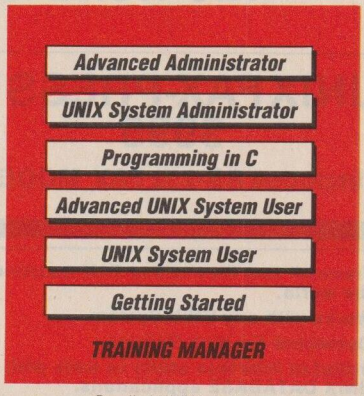

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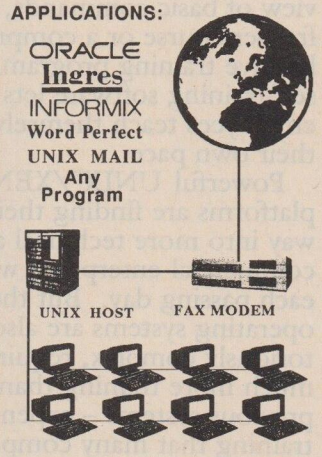

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CIRCLE NO. 105 ON INQUIRY CARD

give examples of frequent usage for 30 common commands.

Review Highlights
Technical Level: Beginner to Expert
Understandability: Average
Summary: Command-line usage for hundreds of SVR4 commands.

RS-232 CARD: SERIAL COMMUNICATIONS REFERENCE
Specialized Systems Consultants; 206-527-3385
8 pages; 1 page of Index & Contents
ISBN 0-916151-42-5 self-covered; $3.00

Computer novices would have a tough struggle with this card. Its real use is as a pocket-sized crib sheet for users with at least a little experience using RS-232.

One page has a few of the most common connections, diagrammed and ready for immediate use. The other seven pages offer technical support information. Pin positions are diagrammed, discussed in a table, and explained in a glossary. This section also covers the mini-RS-232 used on PC ATs. Other sections summarize transmission control, parity, and cable run lengths. For the really technically minded, there are diagrammed summaries of character framing and signal timing. A general glossary and the ASCII character set complete the card.

There's no product-specific help here. Anyone hoping for a verified connection pattern for linking a Brand X computer to a Brand Y peripheral will have to look elsewhere. But the RS-232 journeyman will find all the technical data that's needed, in quick-reference form, and serious novices should be able to learn most of what they need to know somewhere in this card. The only advice worth adding to it is to work minimally. Especially when connecting equipment from different manufacturers, the surest way to make an RS-232 link fail is to connect all 25 lines.

Review Highlights
Technical Level: Beginner to Expert
Understandability: Average
Summary: The bare facts of RS-232 in short form. ■

Editor-at-Large Walter Zintz is the Advisor Emeritus to Uni-Ops Books in Boonville, Calif.

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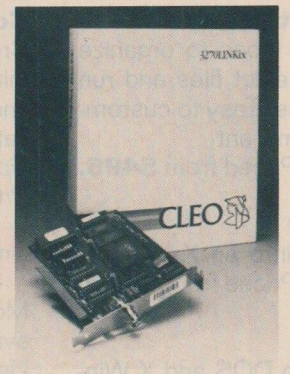

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"SNAKE OIL" INGREDIENTS SUDDENLY LOOK GOOD AT DEC

California, where I reside, is Earthquake Country. But the strong tremor I felt recently was epicentered in Maynard, Mass., headquarters of Digital Equipment Corp. Rated at least 10 on the "snake oil" scale, this shaker occurred when the world's second-largest computer maker announced it would take significant steps to nudge its proprietary hardware architecture and operating system software toward open systems.

Specifically, Digital said it would add support for the IEEE Posix 1003.1, 1003.2, and 1003.4 standards in its VMS operating system; apply for certification and branding of VMS as an X/Open Common Applications Environment (CAE)-compliant environment; add support in VMS for key components of the Open Software Foundation's (OSF's) Distributed Computing Environment (DCE), in addition to already-announced VMS support for OSF's Motif Graphical User Interface (GUI); and move its VAX architecture toward RISC technology in the next two to three years.

All this from a company whose CEO, Ken Olsen, was telling anyone who would listen a short time ago that UNIX was nothing but "snake oil", and could not ever compete with Digital's proprietary software. All this from a company that over the past decade or so spent enormous energy trying to educate the world on the advantages of its seamless, desktop-to-mainframe proprietary VAX architecture. All this from a company that already suffered a major black eye from an abortive attempt to design a RISC-based system. Clearly, momentous winds of change must have hit the staid old mills of Maynard!

The Writing on the Wall

Two key reasons are behind this historic change of heart. One is the realization that the increasing user acceptance of the idea of open systems can no longer be ignored, not even by a company as large and powerful as Digital. The other is that the venerable VAX architecture, despite its admitted advantages, needs major surgery if it is to survive the onslaught of RISC-based offerings with their dramatic price/performance edge. Looking at these trends, and at its poor financial performance over the past two years or so, Digital evidently decided that "if you can't beat 'em, join 'em." Putting it more decorously, the company said its new plans are "aimed at positioning Digital Equipment Corp. as a recognized leader in the world of open systems."

Being a leader in open systems without giving up your proprietary hardware and software technology is a neat trick indeed. How to achieve this transformation is the most fundamental dilemma that all major players in the computer industry will have to solve in the 1990s. How does Digital plan to pull it off?

Momentous winds of change have hit the staid old mills of Maynard

As it turns out, the recipe Digital is using is simple to understand, although it may not be quite as simple to implement. The basic idea is, first, to keep the installed base of VMS users intact. Digital wants its enormous proprietary base to get this message loud and clear: neither UNIX nor Ultrix will replace VMS; VMS is here to stay for the long run.

The next step is to add open systems flavor to VMS by dropping in the necessary facilities to meet the Posix standards and the requirements for X/Open certification and branding.

Specifically, the IEEE Posix 1003.1 "System Interface" standard defines the programming interface to basic operating system services that an application program must use if it is to be portable across various Posix-compliant platforms. Conversely, any Posix-compliant platform must be prepared to respond to such calls in the manner prescribed by the standard. In developing this standard, the IEEE group essentially codified the existing UNIX kernel calls from a number of key UNIX implementations. By adding the appropriate subroutines to VMS, Digital can legitimately claim that "once a VMS application is Posix-compliant, it will be as movable as Posix application written under a UNIX variant."

Digital points out that, as far back as January 1989, it already promised to deliver Posix 1003.1 compliance to VMS. However, it is fairly clear that at that time, Digital's attitude toward Posix compliance was identical to that held by other vendors. Digital now ridicules them as "some vendors [who] apparently consider Posix a bid list checkoff, and limit their support to 1003.1."

Now that Digital is promising VMS support for Posix 1003.2 and 1003.4 as well, it can afford such digs at the competition. Briefly, the Posix 1003.2 "Shell and Tools" standard codifies the calling sequences and responses involved in interacting with the UNIX shell, or command interpreter. It also codifies those involved in invoking system utilities, such as operating system services which are more extensive and complex than those incorporated in the kernel. Posix 1003.4 "Application Perspective Services" currently codifies interfaces to services and facilities which are together known as Realtime Applications support. Digital says it will field-test all three standards in VMS in the first quarter of 1991, and have them available sometime later in 1991.

However, by themselves these Posix standards make only a very modest start in the quest for application portability. Achieving such portability, even at the source level, requires that many more elements of the execution environment be defined by accepted standards.

In this respect, Digital's intent to seek X/Open CAE certification and branding

for the VMS operating system could potentially be far more significant than its Posix commitment. X/Open's Common Applications Environment is the preeminent industry effort to establish such a complete, standard environment. In addition to the basic Posix standards, CAE seeks to also define the data management interfaces (SQL and indexed sequential access), programming languages, networking and communications interfaces, user interface, and (in the future) distributed transaction processing, graphical user interface, system administration and management, security, and other aspects. VMS could be the first non-UNIX based operating system to win the X/Open certification brand–and one of the first to win it under the X/Open Portability Guide Version 3 (XPG3) criteria.

However, Digital was understandably short on details as to the specifics of the X/Open certification it would seek. Most likely, Digital will go for the "base"-level certification, which is essentially equivalent to the Posix standards. In addition, Digital may pick and choose some specific elements of CAE that can be certified on VMS relatively easily, such as SQL and some language standards. Digital also didn't specify a deadline for its X/Open certification.

DEC's OSF Connection

As a founding member of the Open Software Foundation, Digital clearly couldn't get by without saying something about OSF compatibility. Here, plans are much murkier. Digital says VMS will support some unspecified portions of the OSF-sanctioned Distributed Computing Environment (DCE) and the OSF Application Environment Specification (AES). The latter is the OSF equivalent of X/Open's CAE.

Some time ago, Digital enunciated an approach to multivendor environments and interoperability. Dubbed NAS (Network Applications Support), the scheme will have to be reconciled with the OSF DCE approach. Again, Digital hasn't volunteered any details on how this is to be accomplished.

Under a previous announcement, Digital is already committed to support the OSF-defined Motif graphical user interface on both its VMS and Ultrix operating systems.

While on the subject of OSF, it seems Digital has made another shift in direction and is now saying (at least according to press reports) that the Mach-based OSF/1 kernel will be the basis of the next release of Ultrix, Ultrix 5.0. Previously, Digital seemed to indicate that it was moving to a System V-based UNIX offering, with "technology contributions" from Ultrix (Berkeley UNIX), OSF, and others.

So much for the software side. What about the VAX hardware architecture? Here, Digital has apparently made what must have been an extremely painful decision: the tried-and-true, desktop-to-data center VAX architecture is just incapable of keeping up with the intensely competitive price/performance arena created by recent RISC designs. Interestingly, Digital's own abortive attempt to create a RISC design in-house accelerated its move toward a RISC-based VAX.

Forced by customer demand, Digital started marketing, under its own DECsystem label, the MIPS-based series of RISC workstations and servers. The performance and price/performance of these offerings were so superior to the conventional VAX-based models that it was merely a question of time before Digital recognized that drastic action was required in order to salvage its conventional computer line. The most recent examples of this disparity: the RISC-based DECsystem 5100 actually outperforms the far more expensive VAX 6000 Model 500. Both were introduced at about the same time late last year.

DEC's solution is to redesign its bread-and-butter VAX architecture, using RISC principles to catch up with the current price/performance curves. The redesigned architecture would be ready in "two to three years." Significantly, it would still run the VMS operating system.

How is this possible? Digital isn't saying, but the technological options are clear. Assuming that the RISC-based VAX employs a drastically different instruction set (the whole exercise would be more or less pointless otherwise), it will be necessary to convert the operating system and all key system software to the new repertoire. That is no longer as daunting a task as it was just a few years ago, especially once the software has been recoded in a higher-level language.

User applications are a different matter. The majority of such applications today are already written in high-level languages, so converting them to a new architecture could be simply a matter of recompiling, using new compilers that produce the new system's target code. It may also be possible to provide, through a combination of software emulation and hardware microcode assist, a "binary compatibility" mode under which existing VAX-VMS applications could execute on the new architecture, albeit at some yet-to-be-determined performance penalty.

Digital's struggles with the open systems and RISC issues are significant, because the same considerations are no doubt occupying the strategic planners at IBM and all other major computer suppliers, not to mention the second-tier companies (Unisys, NCR, Tandem), all of whom are scrambling to jump on both the open systems and RISC bandwagon.

However, Digital has chosen to approach the problem with more drastic solutions. Re-engineering the basic VAX architecture and the VMS operating system is a far more challenging task than merely offering models based on off-the-shelf RISC chips, and claiming "interoperability" based on support for OSI (Open System Interconnection) standards. Digital's experience may foretell whether the other approaches are likely to survive. ■

Editor-at-Large Omri Serlin heads ITOM International Co., a consulting and resarch firm based in Los Altos, Calif.

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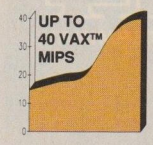

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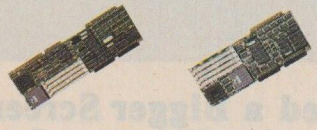

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Max. # of Processors	2	2	2
Bus Architecture	32-bit EISA	32-bit EISA	32-bit EISA
Memory Cache	64-KB	512-KB	512-KB
RAM Std.	5-MB	17-MB	8-MB
Hard Drive	none	330-MB <18ms	240-MB <19ms
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Price	$7,495	$14,495	$20,995

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AN ACTIVIST'S GLOBAL VIEW

By Alan Southerton

Folks in his hometown know Oliver Jones. He's the tall, bearded warden who takes care of Vale Reservation along the Shawsheen River in eastern Massachusetts. Not all of them know what's happened to Jones in his business life–that in the last year or so, he has become a champion among UNIX programmers for writing the first demystifying book about X, called *Introduction to the X Window System*.

Jones is a blend of academia, computer aficionado, free market economics, and environment activist. He respects ideas, methodology, and science, but doesn't wear it on his sleeve. In fact, the average visitor to Vale Reservation is stymied at the professional Oliver (Olly) Jones. What is X? What is the X Window System? What is UNIX? What is an operating system?

A "Jeopardy" match like this can take an afternoon, if Jones goes into detail with a questioner. He weighs such exchanges against his tasks at hand: clearing brush, taking out the park trash, checking on signs, contemplating the environment, kayaking up the Shawsheen, or hiking with Carolyn, Anna, Alice, and Catharine, his wife and three daughters.

"I've always tried to do my part for the environment," says Jones. "It began when I participated in Earth Day in 1970, but afterward, I didn't join an environmental organization. Instead, I worked the concepts into my life and attended teach-ins in the 1970s. It wasn't until six years ago that I joined an organization, and then it was a classic type of organization, a watershed association ...but the people in it were non-classic."

Jones now does volunteer work for his hometown's Andover Village Improvement Society, which maintains Vale Reservation. Although he admits this side of his life takes a back seat to work, Jones says many people in the computer industry want to make a contribution to the "greater ideal of global cooperation and sharing of information.

"A lot of people in the UNIX community are into making a contribution"

—Oliver Jones,
author of "Introduction to the X Window System"

A lot of people in the UNIX community are *into* making a contribution," he says, "and that's what I look for in people when in a hiring situation."

At the office, Jones has more to take care of than a park, but he is still a caretaker of sorts. In his charge is Saber C, the popular programming environment from Saber Software in Cambridge, Mass. Jones is project leader for the development of Saber C, a role that fits well with his activist nature. He views Saber C as improving the lot of UNIX programmers, who he believes deserve better tools. "Using vi to write a program is like using a typewriter to write a C book," he says.

"I've always been interested in making it easier for programmers to program," he says. "I've always wanted to make it possible for other folks to write good UNIX software. But UNIX is imperfect...although it's great that UNIX is imperfect, because we have the chance to shape it as we think it ought to be shaped. We have a chance to contribute."

Jones considers his book a contribution to X, but he is pleased with its commercial success. According to publisher Prentice-Hall, *Introduction to the X Window System* is its most successful X book. Jones says that more than 70,000 copies have been sold and an X11.4 update will come out soon.

When writing his book, Jones read each sentence aloud until he was satisfied with the way it sounded and what it said. To ensure its technical accuracy, he called upon friends and colleagues throughout the X community, including

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several members of the X Testing Consortium at Digital Equipment Corp. "And don't forget the people in `comp.windows.x`," he says, referring to the newsgroup on the internet.

The Second Team

Jones' roots in X are typical ones. Granted, he's the guy who wrote the first X Window System book not based on MIT documentation, but, as Jones says, he still hails from "the second team."

The first team, as anyone involved in X knows, consists of the Project Athena developers at MIT, including the creators of X, Jim Gettys and Robert Scheifler. Jones points out that much of the subsequent development of X, especially for Releases X11.3 and X11.4, occurred within the industry. "The people in the industry," Jones says, "were the second team, so to speak, but they were the ones who actually made X happen."

Jones came to UNIX from one of the early fields it served–molecular modeling, which builds theoretical graphical displays of molecules. "I realized that I was better suited to be involved in the creation of a design, rather than, as a biochemist, to be an unraveler of another design," Jones says.

With degrees in biophysics from Yale and the University of Chicago, Jones obtained a position as a biochemical programmer analyst at the University of California at San Francisco. While there, he continued using the same Evans and Sutherland systems that he had used in graduate school. Shortly thereafter, he took a position as programming manager for a mapmaking company in Chicago–and his computer graphics expertise flourished.

Now age 37, Jones gained his X background as a principal software engineer at Digital Equipment Corp. He joined DEC in 1982 as a field software specialist, which allowed him to learn the industry as well as maintain his affinity to users and the issues confronting them. "Field service is great experience," he says of his job. "It is the toughest job in the business. There is no satisfaction, except for seeing the customer satisfied...which is in and of itself satisfying."

Jones relocated from Chicago to Massachusetts in 1982 and moved into a DEC lab. His first project assignment was the VAXstation 8000, a high-performance workstation in its day. For his contribution, he was named in the patent held by DEC on the system.

At DEC, Jones gained a reputation for versatility. His project involvement included the implementation of a low-level 3-D programmer's interface, performance measurement and evaluation, and fault tolerance and error recovery work. Most of all, the VAXstation 8000 opened the door to X for Jones. He participated in DEC's port of X to the VAXstation 8000. Along the way, he worked with David Carver, who Gettys and Scheifler say was a major contributor to the X11 protocol.

In 1987, Jones moved to another X-powerhouse of the day, Apollo Computer Corp., just up Interstate 495 from DEC. Jones was immediately involved in the development of the graphic subsystem for the highly touted DN10000 workstation.

"Funny thing is, Olly didn't go to work on X right away at Apollo," says Doug Vophries, a senior consulting engineer at Apollo. "I hired Olly for the DN10000 project. I needed someone who could contribute all the way through the project...on both abstract and practical levels. Olly fit the bill perfectly."

After the DN10000 project, Jones returned to X. Not only was he project engineer on Apollo's X server implementation, he later became project engineer on Apollo's user-interface management system for X. Jones recalls that there was a high level of comradeship among X programmers, as well as a participatory spirit at Apollo. "Ideals were at work," Jones says. "The goal was, and is, a complete graphical user interface."

Jones could tell that a widespread commitment to X existed in 1987 when he began lecturing for the Association of Computing Machinery. Then, in 1988, he lectured at Usenix and says "they loved it because they wanted someone to demystify X...to tell them why things were designed the way they were."

"The success of the book is the result of the success of X," Jones says. "X has been good to a lot of people in the industry. It has changed the balance of power. It used to be that hardware vendors ran the industry and software developers spent all their time porting to different systems. Now, because of X, they need only do one port, so they have the chance to create higher-quality software for UNIX."

Jones says he shares in the idealism of UNIX, but he sees X as the driving force in the industry. "UNIX used to be a political statement because it was anti-proprietary. Now it is more than that: it is becoming a pro-user environment, underscored by global cooperation and people making a contribution." ■

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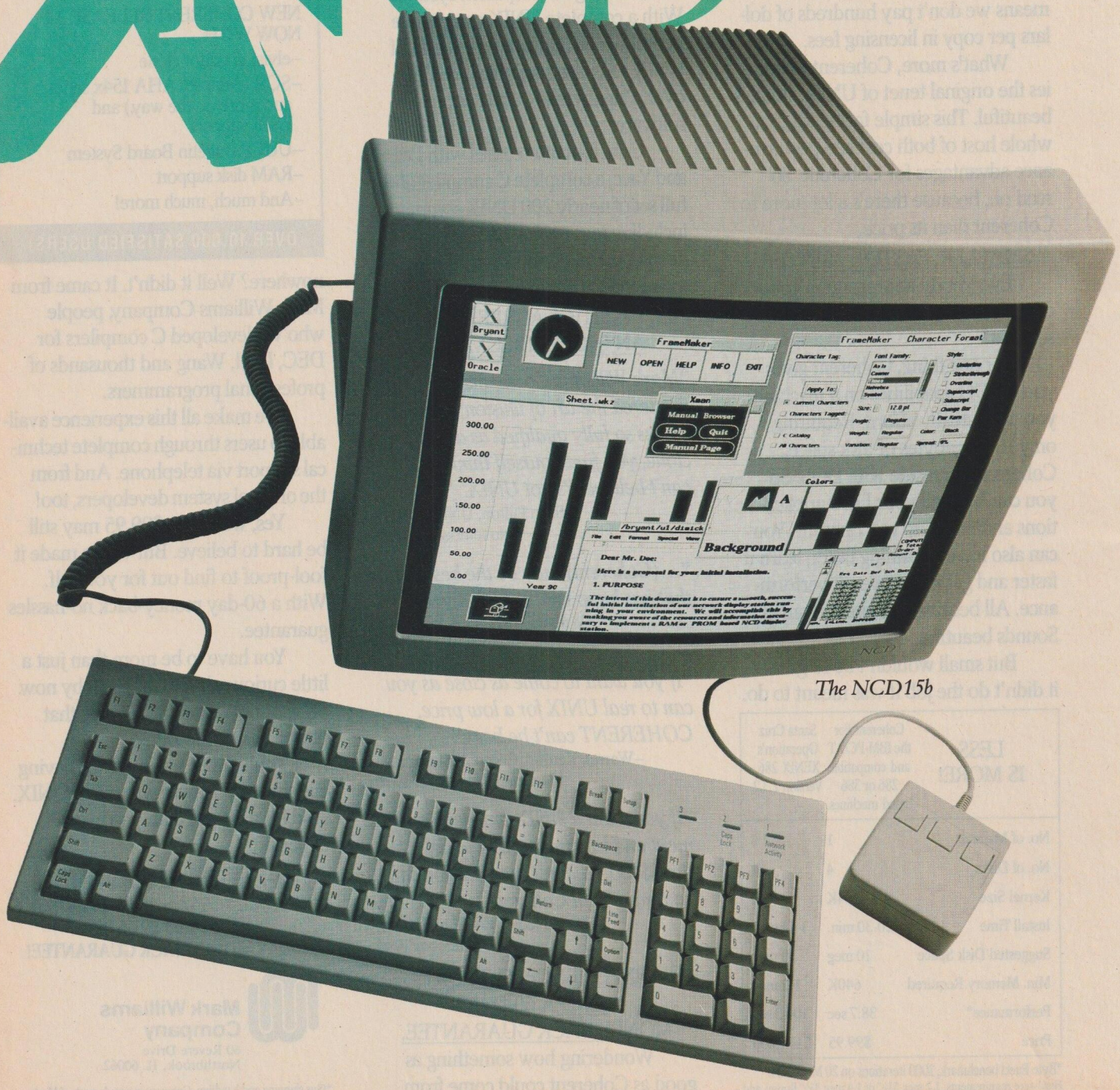

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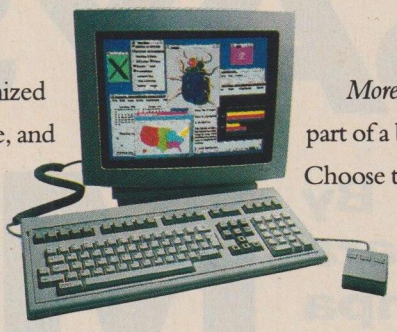

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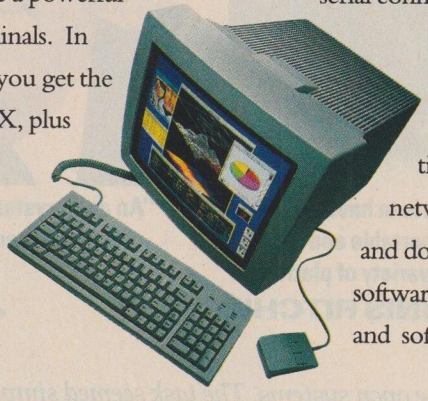

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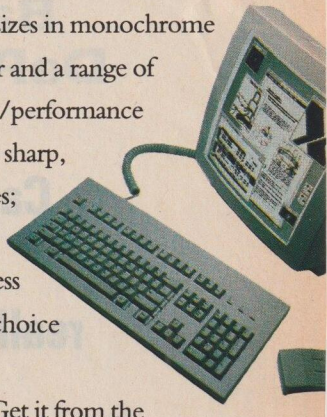

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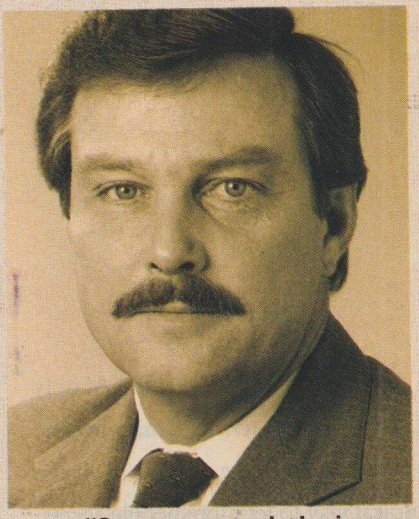
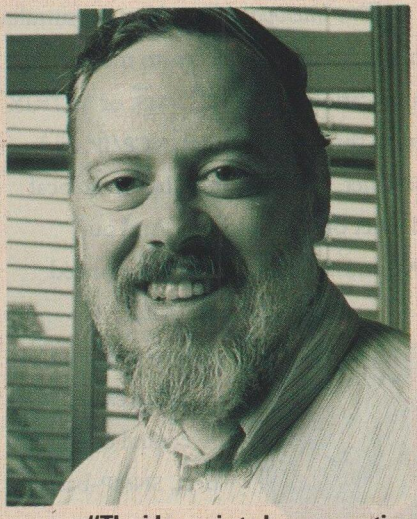
OPEN SAYS ME

By Barbara DePompa

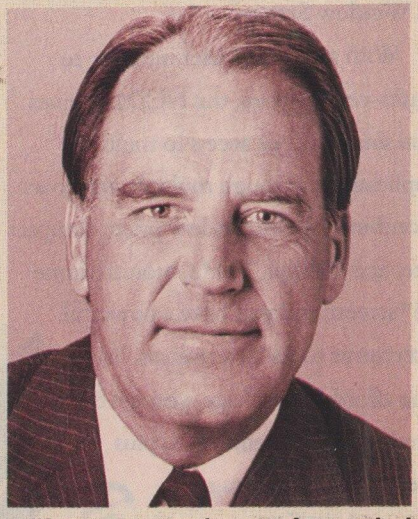
Can anyone really explain what open systems are?



"Open systems... let businesses mix and match different brands and sizes of computers."
LARRY DOOLING

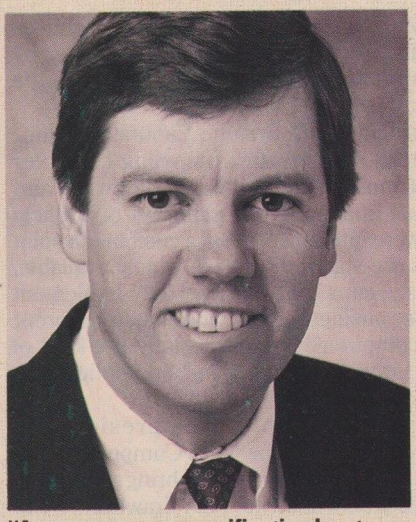


"The idea... is to have operating systems that are portable and run on a variety of platforms."
DENNIS RITCHIE



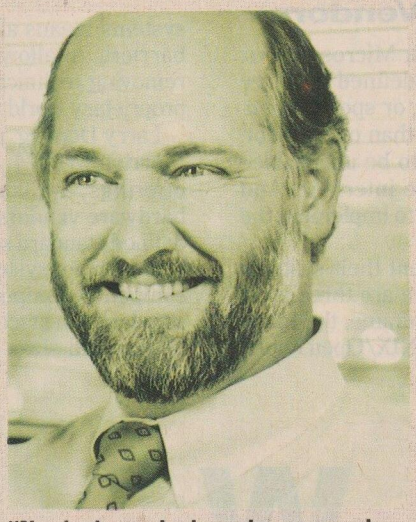
"An open system is a set of networked heterogeneous computers that can work together."
JOHN YOUNG

Define open systems. The task seemed simple enough. But as we soon found out, open systems takes on a different meaning each time another person is asked to define it. So we decided to sample as many industry luminaries as possible, from the primary hardware and software providers to the open systems and



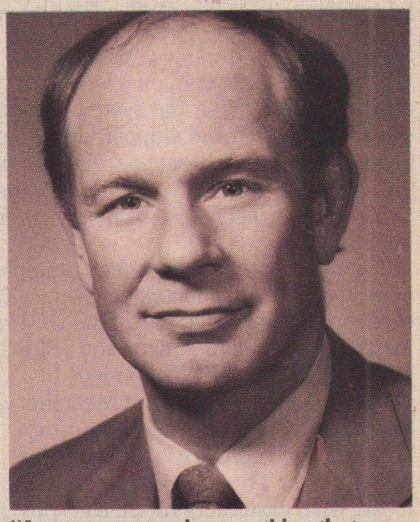
"An open system specification has to be unsueable–you must be able to freely implement the interface."

SCOTT McNEALY



"No single vendor has a large enough role to make open systems work across the board."

DAVID LIDDLE

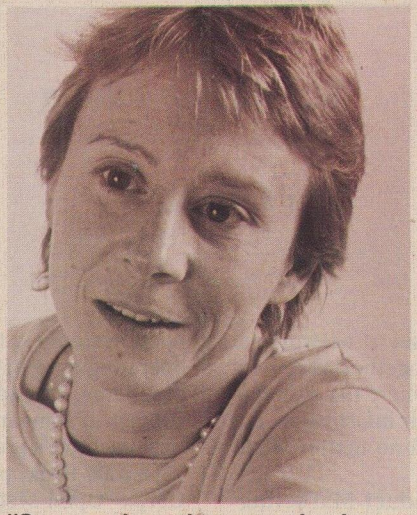


"An open system is something that must be able to interoperate with unlike systems."

DAVID TORY

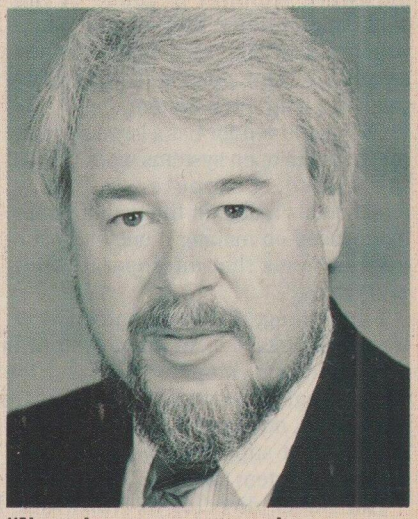
"Applications should run on a full range of architectures, from laptops to mainframes."

PETER CUNNINGHAM



"Openness is vastly overrated and underachieved. It basically means everything works on everything else."

ESTHER DYSON



"Nowadays, open systems is a lot like artificial intelligence was ten years ago."

BRIAN BOYLE

standards promoters to an assortment of industry pundits and soothsayers (or rather truth sayers). Their definitions lend insight–and sometimes comic relief–to create a perfect snapshot of the evolution of open systems. In addition, some of the experts' comments show how far we still must go to achieve a true open systems environment in the decade ahead.

continued

DEFINING OPEN SYSTEMS

Hardware and Software Vendors

Scott McNealy, president and CEO of Sun Microsystems: "Put very simply, an open system can be defined by three characteristics. First, the system interface, or specification, must be available and shipping from more than one vendor. Second, an open system specification has to be unsueable–you must be able to freely implement the interface. And finally, it must be tax-free, or nearly tax-free to implement the interface.

"Companies that charge fees to implement their systems interface are fundamentally not open. There are three open systems on the market today: the IBM mainframe, the Intel/Microsoft-DOS environment, and SPARC/UNIX/Open Look/ONC [Open Network Computing]."

David Liddle, president of Metaphor Computer Systems Inc., Mountain View, Calif.: "There are currently three definitions. There's what vendors mean, what customers mean, and what intellectuals mean. When customers say they want open systems, they want to acquire hardware, systems software, and applications to mix and match. They don't want to be stuck with one hardware supplier because of the application choice they made. When vendors describe open systems, they mean only being good at making a few parts of a truly open system.

"No single vendor has a large enough role to make open systems work across the board. Computer industry intellectuals maintain that vendors are too focused on making money to make open systems that interoperate with everything."

What open systems is depends on whom you talk to

John Young, president and CEO of Hewlett-Packard: "An open system is a set of networked heterogeneous computers that can work together as if they were a single integrated whole–no matter where the systems are located, no matter how they express their information, no matter what supplier produced them, and no matter what operating system they use."

Jim Davis, director of Worldwide Product Marketing System Software, Apple Computer: "Open systems are popular fiction. To truly qualify as an open system a product must be so generic and standard that the user sacrifices the added value [that] a product from a technology innovator like Apple can offer."

Nick Donofrio, president of IBM's Advanced Workstation Division, Austin, Tex.: "SAA [IBM's Systems Application Architecture] has become open with its interoperability with UNIX and its ability to provide portability across a variety of platforms. AIX interoperates with UNIX, and AIX and SAA also interoperate. Open systems are ANSI-standard computers that run OSI [Open System Interconnection], the token ring network, and Ethernet, and offer both interoperability and applications portability, as well as systems developed through an open process."

Joe Burns, director of UNIX Marketing, Unisys, Blue Bell, Pa.: "My definition comes from customers' perspective. Open systems means allowing the customer to have no technical barriers, to allow him to take advantage of that power by removing technical constraints that customers face from the proprietary world today."

Larry Dooling, president, UNIX Systems Laboratories Inc., Morristown, N.J.: "Open systems are competing computer offerings, available from a large number of software and hardware vendors, that implement the same set of publicly defined standard software interfaces. From a customer's point of view open systems are standards-based, widely available, competing computer systems that–because they implement standard interfaces–let businesses mix and match different brands and sizes of computers to build exactly the kind of integrated or networked applications they need."

Bud Tribble, vice president of engineering for Next Computer: "The open systems concept brings two main benefits and two main drawbacks. The first benefit is a set of defined standards (ranging from network standards to binary shrinkwrap standards) to provide easy interoperability and connectivity. The second benefit is price competition and vendor independence, because more than one vendor offers a compatible system.

"The two big down sides to open systems are a tendency to stifle innovation once the standards are set and an unfortunate gravitation toward the lowest common denominator among the various vendors."

Dennis Ritchie, one of the original developers of UNIX and the current head of computing techniques research department at AT&T: "The idea behind open systems is that it's now technically possible to have operating systems that are portable and run on a variety of platforms. In addition, those operating systems are also subject to standards that are independent of any particular manufacturer's products."

Dennis Peck, president and CEO at Interactive Systems Corp.: "Open systems is really about providing software so that heterogeneous computing platforms are interoperable. UNIX System V software provides compatibility among different hardware platforms and allows easy migration from desktops to mainframes and across networked environments."

Promoters of Open Systems

Ed Palmer, executive director of UniForum, Santa Clara, Calif.: "Open systems are systems which conform to published standards developed by accredited standards development organizations through a consensus process within open forums and which provide published informational descriptions. I plan to stick to the more technical definition as long as some vendors are trying to bend the definition to include every operating environment possible."

continued

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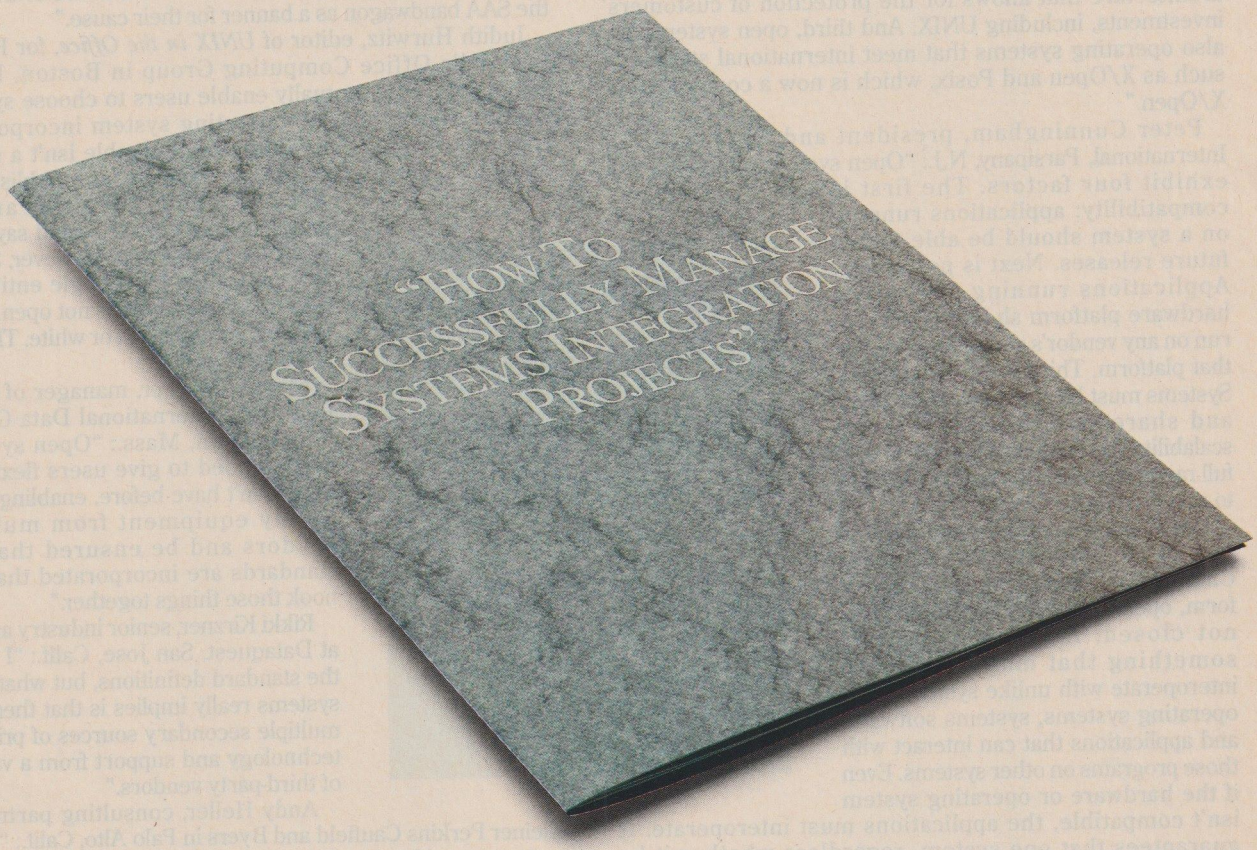

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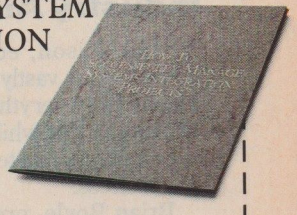

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DEFINING OPEN SYSTEMS

Tom Vassos, president of UniForum Canada, and product manager for the RS/6000 for IBM Canada, based in Ontario: "There are three definitions. First, open systems can be defined as any environment that protects the customer's investment in technology. Not only UNIX, but SAA would qualify here. Second, open systems is defined as any architecture that allows for the protection of customers' investments, including UNIX. And third, open systems are also operating systems that meet international standards such as X/Open and Posix, which is now a component of X/Open."

Peter Cunningham, president and CEO of UNIX International, Parsipany, N.J.: "Open system computing will exhibit four factors. The first is compatibility: applications running on a system should be able to run future releases. Next is portability. Applications running on a given hardware platform should be able to run on any vendor's computer based on that platform. Third is interoperability. Systems must be able to work together and share data. Finally, there is scalability. Applications should run on a full range of architectures, from laptops to mainframes."

David Tory, president and CEO of the Open Software Foundation, Cambridge, Mass.: "In its simplest form, open systems is anything that's not closed. An open system is something that must be able to interoperate with unlike systems. It is operating systems, systems software, and applications that can interact with those programs on other systems. Even if the hardware or operating system isn't compatible, the applications must interoperate. It guarantees that one system, regardless whether it be hardware-compatible, will provide portability from that single environment to another."

Comic relief and confusion from the experts

Industry Analysts

Esther Dyson, editor of *Release 1.0*, New York, N.Y.: "Openness is vastly overrated and underachieved. It basically means that everything works on everything else. Today, the situation is that while a large number of companies offer what they call open systems, nobody wants to support their brand of openness."

Brian Boyle, president of the Novon Research Group, Berkeley, Calif.: "Nowadays, open systems is a lot like artificial intelligence was ten years ago. It's also a lot like miracle fabrics, motherhood, and apple pie. Openness can't be applied to a single vendor. Open systems will really be an interface definition that enables users of differing systems to communicate with systems of different sizes, operating systems, data formats, even human languages, and still take advantage of the commonality between those systems."

Brian Jeffery, managing director of International Technology Group, Los Altos, Calif.: "If you ask six end users you'll get six different responses. Underlining the movement to open systems is end users' desire for more control–[control] over portability, connectivity, and everything else that troubles users today. In addition, open and proprietary systems are not contradictory terms. Instead, open systems is being hijacked by everybody from UNIX-lovers to those on the SAA bandwagon as a banner for their cause."

Judith Hurwitz, editor of *UNIX in the Office*, for Patricia Seybold's Office Computing Group in Boston, Mass.: "Standards will eventually enable users to choose systems without regard for the operating system incorporated. However, making everything interoperable isn't a simple thing. It's a continuum. SAA, for example, now publishes its APIs [application programmer interfaces] so that one could say there is an "openness" to it. However, SAA is still controlled by a single entity and thus, in a pure sense, is not open. Open systems are not black or white. There is still a lot of gray."

Maggie Konner, manager of UNIX Research, International Data Group, Framingham, Mass.: "Open systems are intended to give users flexibility they didn't have before, enabling them to buy equipment from multiple vendors and be ensured that the standards are incorporated that will hook those things together."

Rikki Kirzner, senior industry analyst at Dataquest, San Jose, Calif.: "I know the standard definitions, but what open systems really implies is that there are multiple secondary sources of primary technology and support from a variety of third-party vendors."

Andy Heller, consulting partner at Kleiner Perkins Caufield and Byers in Palo Alto, Calif.: "Open systems provides a few common APIs so that applications can port in source form.

"Customers are looking to be free to move to various platforms. Vendors within that context are looking to provide high availability or high performance to attract users to their hardware. Applications vendors are looking to not tying themselves to any single-vendor base so they can best spread around their investment in programming."

Now What?

At this point you may be hopelessly confused. Don't worry, most people are. Our October 1990 issue's story, "Open Systems? Huh?", revealed that most managers of information systems couldn't define open systems either.

When faced with such a variety of opinions from different sources, it's difficult to make sense out of the hype and misinformation. To find out what UNIXWORLD, the magazine of open systems computing, thinks open systems is, see our Editor-in-Chief's editorial on page 9. ■

Barbara DePompa is a business and technology writer. She was previously the hardware editor at MIS Week.

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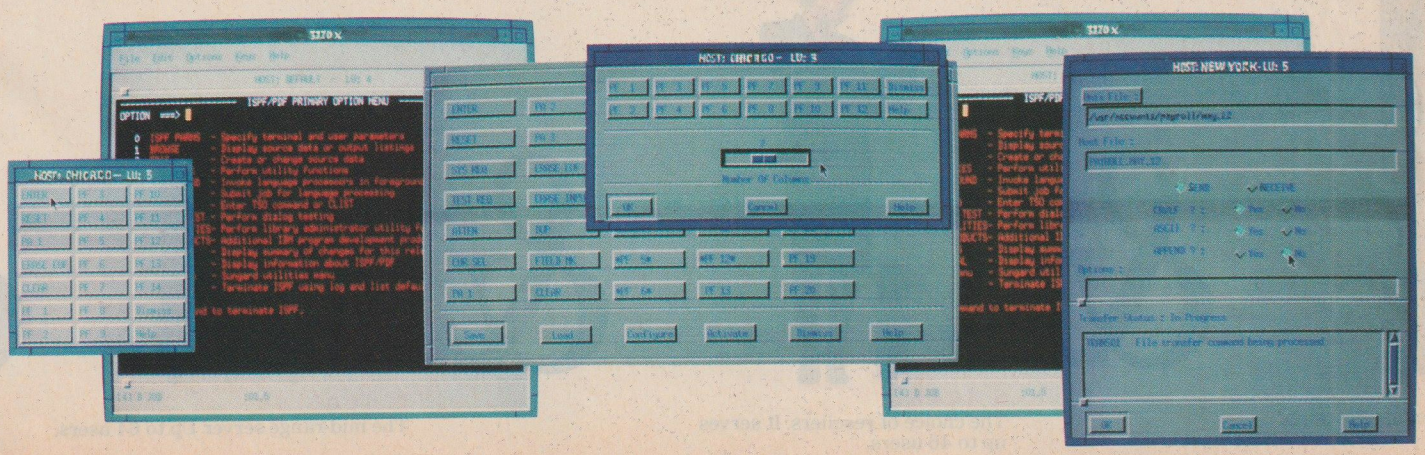

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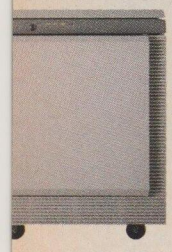
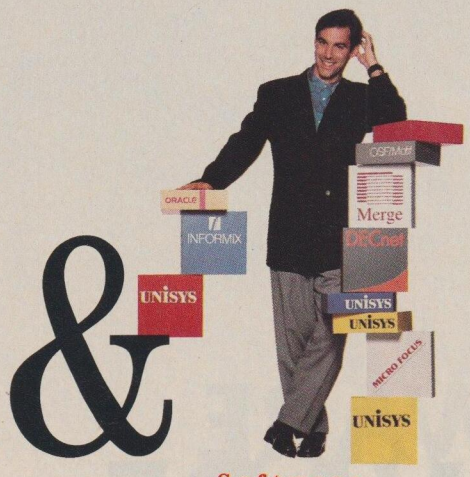
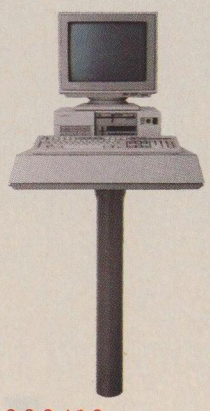


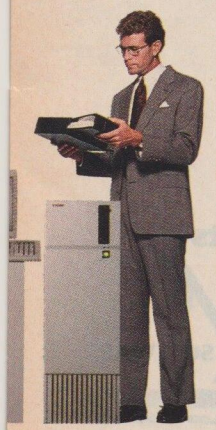
ultiple processor
users.



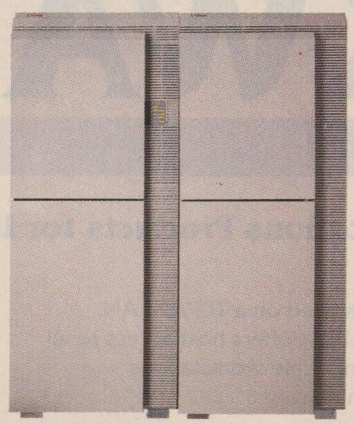
Software
50 popular software packages from 30 independent vendors packaged as a comprehensive solution platform.



U 6000/10
The low-end UNIX based server. Up to 16 users.

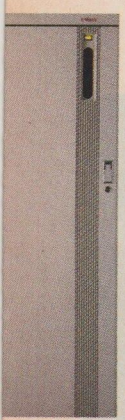


e with a wealth of
o 80 users.



U 6000/80
The large-scale multiple processor server. Up to 400 users.

Customer Education
Custom and standard courses improve effectiveness of UNIX based systems installations.



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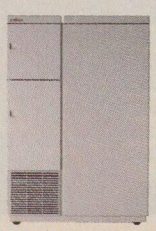

U 6000/60
The mid-range server. Up to 64 users.

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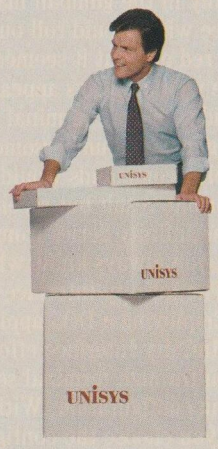

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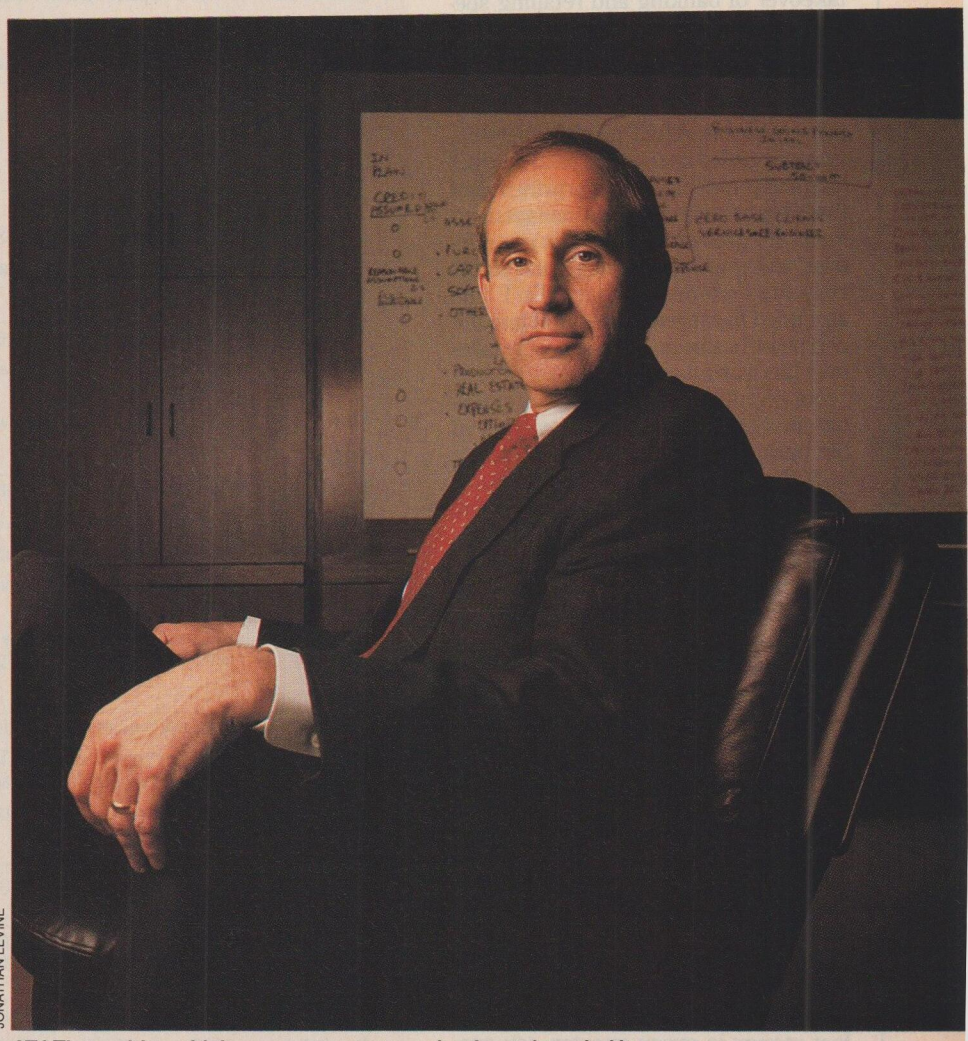
CIRCLE NO. 245 ON INQUIRY CARD

Can A Cash Register Company Fix The Phone Company?

AT&T attempts a hostile takeover of NCR to solve its computer business problems



JONATHAN LEVINE

AT&T's troubles with its computer systems business have led it to turn to NCR for the solution. "We have a lot of respect for NCR's management team," says AT&T's Rich McGinn (above).

By Gary Andrew Poole

A few years ago a group of AT&T Computer Systems salespeople met in Atlanta for a conference. They came to show potential customers that AT&T had finally turned a corner in its computer business.

"It was pathetic," says one analyst who attended the conference. "There were salespeople who were trying to figure out how to plug in a computer."

Incidents like these are the legacy of AT&T's computer systems business, tarnished by seven years of hellish turmoil. Its installed base has declined, senior salespeople have left, and vaults of money have been lost, say analysts. One high-ranking source at AT&T, one of many people interviewed for this article who feared repercussions if his name was used, says AT&T Computer Systems will finish 1990 with less than $1.5 billion in revenue. The division has reportedly lost between $200 and $300 million in operating expenses a year.

continued

Despite these problems, AT&T has tried positioning itself as a company starting over with an ambitious new distributed computing and networking plan. It calls the strategy "network computing," and hopes it will move AT&T into the major league shared by such giants as Hewlett-Packard and Sun Microsystems. Up until December, it looked like AT&T was full-speed-ahead with this plan. Then the phone giant concluded that its problems couldn't be solved alone. The antidote to its cancer was NCR Corp., another huge U.S. company with a similar computing scheme, called "open, cooperative computing."

Its $6.12 billion ($90-a-share cash offer) takeover of banking and retailing specialist NCR, known in the UNIX world for its popular Tower line of supermicrocomputers, is an indication of AT&T's desperation to be successful in the computer business. AT&T needs leadership, European sales channels, a solid product line, and profitability. NCR provides all of these elements through its management team, its presence in dozens of countries, a new product strategy, and stable revenues–elements that AT&T has struggled to achieve since it got into the computer business. But the hostile takeover has many downsides.

No multibillion-dollar, high-technology merger has been an easy walk in the park. (Look at the troubles Sperry and Burroughs had when forming Unisys.) NCR has just introduced a new computer product line–the 3000 line–which analysts have predicted will create a revenue shortfall for the next two years as shipment delays occur and customers wait to buy new models.

Many analysts say these problems can be overcome, but AT&T has to face another more critical problem. Charles E. Exley, Jr., NCR's president, and other senior executives and managers are threatening to leave NCR. If this brain drain occurs, AT&T could be left with a company without a vision. AT&T has always struggled with its own vision.

The Legacy

Since 1983 when AT&T was allowed by the federal government to enter the commercial computer business, it has lost money in every quarter, say analysts. Initially it decided to sell personal computers and minicomputers. AT&T didn't make any money in its minicomputer business because it was a year too late. The market had leveled off.

Its foray into the PC business has had similar problems. Its IBM-compatible PC was seen as a decent product by customers, but production and delivery problems with its PC maker, Olivetti & Co., stalled sales. "Olivetti was a slimy company, and we trusted them like a brother," laments one former AT&T employee. "We were suckers."

In May 1988, Bob Kavner, then a president of AT&T's Computer Systems business, ended the relationship. The deal was scrapped, and a new agreement was made with Intel.

Meanwhile, the value of AT&T's worldwide UNIX shipments fell by 5.8 percent from 1988 to 1989, according to International Data Corp. AT&T is a leader in the U.S. UNIX market, but it

AT&T's Ups and Downs

1984	
April	AT&T and Olivetti form a strategic relationship to develop and market PCs in the United States.
April 2	AT&T announces plans to sell 3B minicomputers through VARs and to large corporate users.
June 26	AT&T introduces its first personal computer, the Olivetti-manufactured PC 6300.
August 12	AT&T announces plans to market PCs and 3Bs through Master VARs.
1985	
September 10	AT&T and EDS announce $223 million contract to supply computers to the U.S. Department of Agriculture.
October 29	AT&T Computer Systems introduces the PC 6300 Plus.
1986	
March 24	AT&T StarLAN networking software and hardware introduced; AT&T PC 7300 (the UNIX PC) introduced.
October 29	Vittorio Cassoni leaves Olivetti to become senior vice president at AT&T Computer Systems.
1987	
March 24	AT&T introduces the 3B2/600.
September 2	AT&T introduces the 6386 WGS computer, 3B2/500 and 3B4000.
October 15	Vittorio Cassoni named president of newly formed Data Systems Group.
1988	
January 6	AT&T agrees to buy up to 20 percent of Sun Microsystems.
April 25	Vittorio Cassoni returns to Olivetti. Bob Kavner named president of Data Systems Group.
May	AT&T ends exclusive contract with Olivetti and puts PC contract up for general bid.
1989	
March	Bob Kavner named AT&T Group Executive.
March 8	3B2/1000 family of computers introduced.
June 18	Gordon Bridge and Rich McGinn named co-presidents of AT&T Computer Systems.
July 11	AT&T and Intel sign an agreement to produce 386-based PCs. A week later, a new line of PCs is announced.
October	AT&T and Pyramid Technology sign a partnership for joint marketing and development of UNIX-based high-performance systems.
1990	
March	Rhapsody Business Orchestration System announced.
March	AT&T Computer Systems and Tandem announce alliance for joint marketing and development for UNIX-based fault-tolerant systems.
April	AT&T Computer Systems enters RISC market with announcement of AT&T System 7000.
April	AT&T Computer Systems announces UNIX System V Release 4.0 Developer's Package for 3B2s and 6386 WGS.
June	AT&T Computer Systems announces two dozen new products at Comdex, including the StarServer E, the first symmetrical multiprocessing machine in the Intel class; and StarServer FT, a UNIX System V-based RISC fault-tolerant platform for the commercial marketplace.
July	Rich McGinn named sole president of AT&T Computer Systems.
November	AT&T makes $6 billion hostile takeover bid for NCR.

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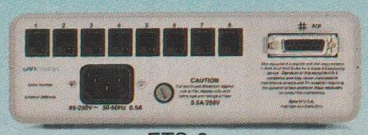

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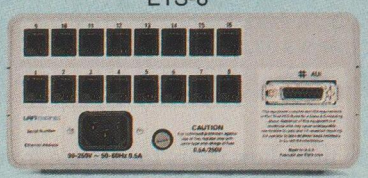

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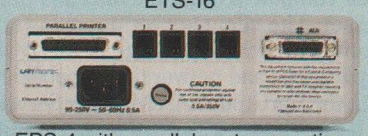

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has a significant stumbling block in that the company sells only a fraction of its systems outside the flat U.S. market. Its share in the U.S. market is 10.1 percent, according to IDC, but its share of the worldwide UNIX market is only 4.8 percent. (NCR generates 60 percent of its revenues outside the United States.)

On the software side AT&T had problems too. While it developed the UNIX operating system, and had the power to license and change the system, AT&T has never made money on UNIX, according to some sources.

The Revival

AT&T can't change history. Up until December, AT&T's company line was: "Sure we've had our problems, but we're looking better all the time." And before the takeover attempt was announced, some analysts agreed.

"For the first time in their history AT&T is positioned well," said Tom Willmott, a vice president of the Aberdeen Group, a marketing firm. "They have much more horsepower today than they've ever had."

AT&T had been implementing a plan for 18 months, which touched some industry watchers with a spat of optimism. AT&T went back to its networking roots with a computer networking strategy aimed at capitalizing on its existing resources. (A strategy, by the way, that's similar to NCR's.)

Eighteen months ago, Bob Kavner and his management team began developing the new strategy.

"What we did was set out to make the best networking software, networking hardware, and servers out there to support the client machine," says Rich McGinn, who is now the president of AT&T's computer systems business.

Last year AT&T announced additions to its high-performance 7000 Series, a RISC-based symmetric multiprocessing system developed with Pyramid. The 7080 Release 2 provides up to 34 percent faster performance than current AT&T models. New enhancements to the series include the integration of SCSI peripherals, and the Tuxedo Release 4.0 System/T for networked transaction processing.

In September 1990, AT&T introduced its high-performance StarGroup LAN Manager Server network operating system and a systems manager. All of these products, and its well-regarded Rhapsody operating environment, were aimed at capitalizing on the burgeoning distributed computing market. In the distributed model, the workload is shared among different computers, and resources are allocated by the network. Rhapsody has scalable UNIX server products that allow users to migrate from their computers using the Intel 386 processor. The client-server operating environment includes a range of MS-DOS applications and networking capabilities with the StarGroup LAN Manager Server.

If the merger with NCR is successful, AT&T's entire product line will be reevaluated, with duplicate products likely to be eliminated, says Kavner.

AT&T Computer Systems' Largest Sales

Purchaser	Total Amount*	Date Awarded
U.S. Air Force	$929 million	October 1988
Federal Aviation Administration (Office Automation and Technology Services)	$853 million	December 1989
Pan Am	$40 million	May 1990
United Parcel Service	$29 million	January 1990
Firestone	$25 million	July 1989
Trusthouse Forte (Hotel/motel chain)	$16 million	June 1988
McDonald's	$15 million	February 1988
Xerox	$15 million	March 1988
Amtrak	$14 million	June 1990

*Estimated

The Ongoing Sale of UNIX

AT&T has wrestled with its UNIX strategy ever since the birth of the Open Software Foundation, an organization that has developed its own UNIX operating system to compete head-on with AT&T's. Last year Bob Kavner, AT&T group president, announced that AT&T's UNIX System Laboratories (USL), the organization that oversees the development of AT&T's UNIX, was for sale.

AT&T is distancing itself from USL because of industry-wide apprehension that AT&T wants to dictate the course of UNIX through this wholly owned subsidiary. Hewlett-Packard, Digital Equipment Corp., and IBM have allied themselves with the Open Software Foundation to circumvent AT&T's perceived industry-wide control of UNIX.

Despite Kavner's desire to sell USL, he has been unsuccessful to date. The reported price tag of $400 million is not the reason there have been no takers, say sources close to the deal. It's the stifling conditions. "I compare the conditions of the deal to buying a brand-new car and only being able to drive it two days a week," says one source at the OSF.

Before the AT&T takeover bid, Kavner was willing to sell a 70 percent equity share but wanted AT&T to retain control. Now he is willing to consider equal shares and retain a minority interest.

Kavner is in the unenviable position of selling a popular development organization whose staff is known internally at AT&T as the "Fair-haired Boys." If he puts USL publicly on the auction block, he could see employees, his resources for UNIX research and development, running for other jobs.

"I honestly think he must solve this problem in six months to a year, or USL's future is at stake," says one former employee.

Kavner has tried to sell USL to some cash-rich Japanese companies recently, but rumors that he tried to sell it to the Open Software Foundation are unfounded, says a source at OSF. —*G.A.P.*

AT&T's Internal Angst

AT&T must now overcome image, brain drain, and money problems. Kavner and his existing management team have to fight against a history of failure, which left many customers dubious of AT&T's technology, service, and support. Kavner, who is now a group executive at AT&T, has been criticized as distancing himself from

the Computer Systems business.

"We've improved considerably," he said vaguely, before AT&T's takeover bid of NCR, which he reportedly orchestrated.

Before Kavner left for higher ground to group executive, he made many changes. Most analysts cheered them, but the perception of AT&T hasn't changed. It's still not thought of as a computer company. Before the takeover bid, management contended this perception was changing, but others had doubts. "Their customers are totally flabbergasted," says one former employee, referring to many of the changes at AT&T.

Robert Allen became AT&T's CEO after the death of James E. Olson in April 1988. He has tried to give a higher degree of autonomy to each business unit through a decentralization effort. His management team has favored this move. "There's been big changes in management philosophy and behavior," says Rich McGinn. "We're now operating as an individual business. We're more responsible. We're more fleet of foot."

The business has also tried to target its markets more closely. "We used to stand on a corner and fight with anyone," says Curt Crawford, vice president of sales, service, and support for AT&T's computer systems.

New Reliance on Outside Vendors

Tom Willmott with the Aberdeen Group has said AT&T's joint-development alliances have "put spark" into its existing product line, no pun intended.

These alliances, most significantly those with Pyramid Technologies, Intel, and Tandem, were putting AT&T closer to its goals as a "solution" provider, say AT&T executives. (At press time AT&T executives say these alliances were unaffected by the takeover bid.) The Pyramid and Tandem deals are for high-end systems. "This has been a great agreement for us," says Ed Scott, executive vice president at Pyramid. "We've doubled our expectations." He says Pyramid expects to have $30 million in sales in 1990 relating to its AT&T OEM (original equipment manufacturer) agreement.

"These relationships are crucial to us," says Scott Perry, AT&T's vice president of marketing and strategy for computer systems. "Customers don't want to buy a bag of parts. The relationships enhance our integration capabilities."

Systems integration plays well into the division's concept of network computing. "We all go to the same place for our chips, our power supplies, or DRAMs," says Rich McGinn. "But customers are saying they want to take advantage of all the great horsepower of PCs through networking. People need to think of us as people that solve their business problems more than they think of us as a computer company."

Unfortunately, the profit margins for a systems integration company are much lower than for a straight system seller because the expense of training systems integrators is much higher than simply shipping boxes. But AT&T has positioned itself as a systems integrator because its strength is in its extended sales force, which spreads across the United States.

"We decided to go with AT&T for two reasons," says Paul Linnee, director of communications for the City of Minneapolis, which recently spent about $1 million for equipment and services from AT&T. Linnee says AT&T's tradition of UNIX expertise and its local presence, not its products, helped sway the decision.

AT&T's systems integration approach has its critics, who say the philosophy is ineffective because many of its top salespeople with technical expertise are leaving the company.

Set for the Long Haul

Overall, AT&T has made some major changes from a company so easy to bash in the 1980s. All of these changes, from the new products to the alliances, could end if the NCR deal goes through. No one knows yet which products will be kept alive and which will die, and Rich McGinn says no decision has been made. AT&T has said that NCR's products take precedence over its own.

The problems AT&T will have with the takeover of NCR are monumental. NCR's management is upset, high-tech mergers are typically flops (Sperry/Burroughs is one example), and the overall malaise felt by NCR doesn't bode well for a company expecting success. "We have a lot of respect for NCR's management team," says AT&T's Rich McGinn. Along with many of his colleagues, he may be out of a job soon. "It will be a big loss if Exley [and his team] leave," he admits.

AT&T made a bold move by going after NCR, but the odds are against success. In fact, at a recent computer conference when an analyst asked Kavner if he could name any high-tech mergers that have worked, he replied, "No, I cannot." AT&T is fighting history, its own failed vision, NCR's disgruntled management team, and a slew of other problems. AT&T's computer business is broken. On paper, NCR is a great company to acquire because of its new product line, European presence, and good management team (if it can be appeased), but companies aren't like machines. A broken part can't always be replaced. ■

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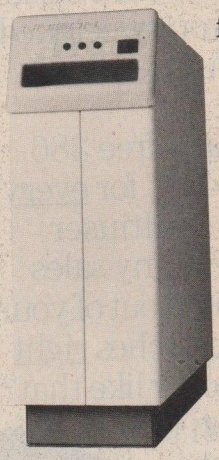

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CIRCLE NO. 96 ON INQUIRY CARD

E-Mail to the Outside World

What Is UUNET And How Can It Help You?

For many years, using UNIX mail as a communication tool has been an arcane art, understood only by insiders. Mysterious designations have graced business cards and papers. Some of the author biographies in UNIXWORLD end with lines like uunet!uworld!rik or tut@sun.com.

Even if you know that these codes constitute a path just like a phone number, it doesn't mean

BY RIK FARROW

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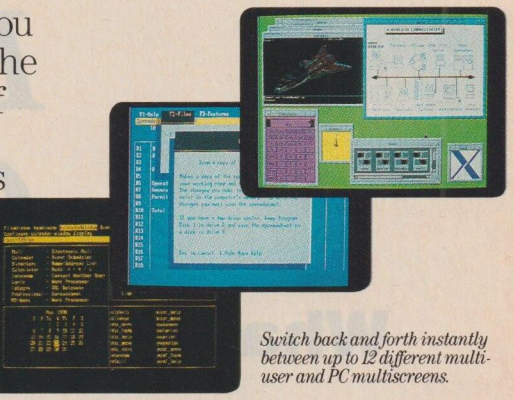

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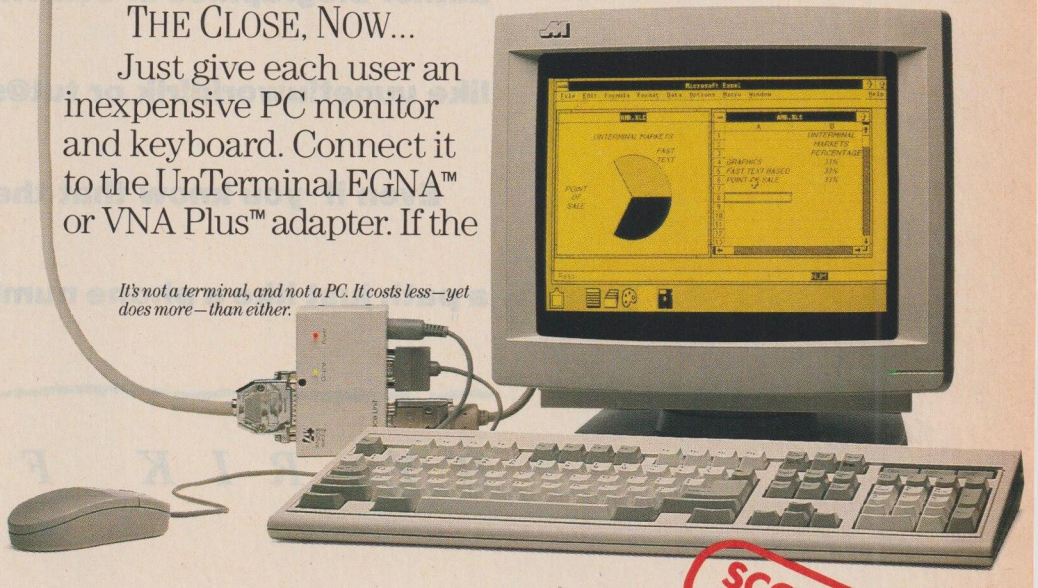

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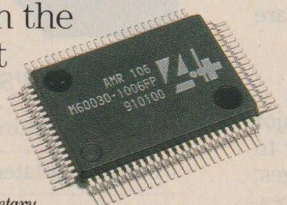

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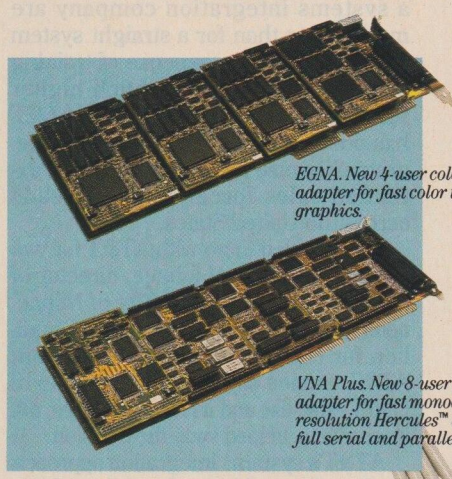

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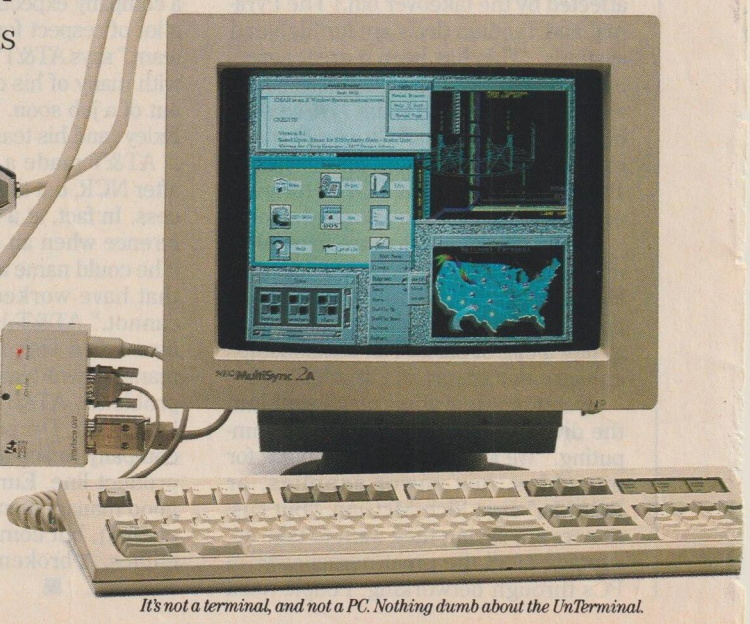


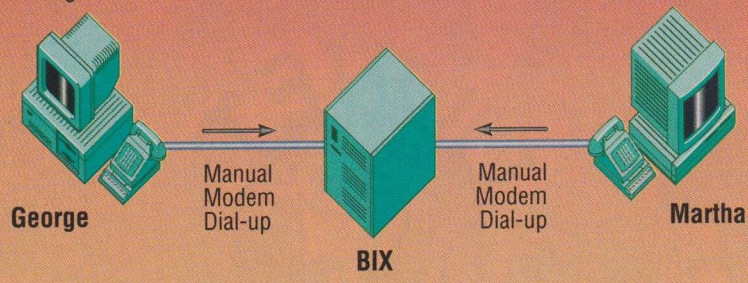
It's not a terminal, and not a PC. Nothing dumb about the UnTerminal.

ANDREW SHACAT

Checking the Mailbox

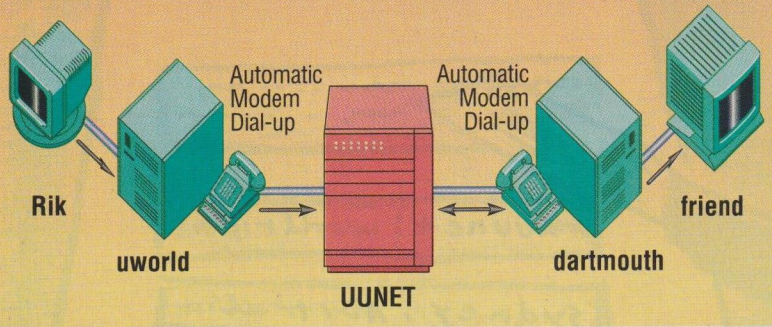
Dial-up Mailbox Service

Using a dial-up mailbox service, George manually calls BIX, logs in, and leaves mail for Martha. Later, Martha also calls BIX, logs in, checks for messages in her mailbox, and retrieves the mail from George.



Store-and-Forward System

In the store-and-forward system example, mail is sent by Rik to the address friend @ dartmouth. Rik's system, uworld, uses UUCP to automatically dial-up the UUNET system and forward the message. The message is stored on the UUNET system until the dartmouth system automatically calls (or is called) and retrieves any mail directed toward it. The dartmouth system then notifies the user, friend, that there is new mail; friend uses a mail-reading program to read the message from Rik.



you can tap the international communications network that supports their use.

UUNET is the non-profit corporation dedicated to providing this service. It now operates a computer dedicated to exchanging mail and news. Anyone with a UNIX computer (or even a PC running DOS) and a modem can participate. UUNET provides a service by acting as a hub, receiving messages and forwarding them to recipients. UUNET also makes network administration simple, by taking over most of the work, and even helping newcomers get started.

Today, universities, hardware and software vendors, and researchers (all insiders) still make up the bulk of UUNET sites, which are organizations with computers running UUCP, TCP/IP, and news software. Of the 1,700 UUNET sites, fewer than one quarter are operated by newcomers–outsiders who have learned of the advantages of electronic mail services. These newcomers are people who have added international UNIX mail and news to their arsenal of technological skills to make them more successful in today's world.

UUNET (UNIX-to-UNIX Network) has the potential to demolish the barrier between the insiders and everyone else. Now, lawyers can exchange briefs from coast to coast, management can receive sales reports from Europe, and software vendors can support customers worldwide by using UNIX mail. UNIX mail, unlike fax machines, provides unattended transfer of text between remote systems. Also unlike a fax or voice mail, UNIX mail allows the recipient to respond immediately when receiving the message (no telephone tag or printing out hard copy for the fax machine). Also, once a message has been received, it may be edited, retransmitted, or printed locally.

Along with UNIX mail comes another of the insider advantages–Usenet. Usenet is the largest distributed network in the world. It consists of newsgroups–groups of people sharing opinions, ideas, and information about specific topics. People use Usenet for practical purposes, such as finding jobs, posting resumes, choosing new software, or getting honest answers to problems faster than a vendor could respond. Usenet also provides entertainment, with topics ranging from sex, drugs, and rock 'n' roll to political events or the best GUI.

If this isn't enough, UUNET is a repository for the latest public domain software. More than 50 megabytes of source files and documentation makes up the library of public domain software. These source files are uncompiled versions of software that take some expertise to install, but can also provide low-cost solutions to many problems.

What is Electronic Mail?

Electronic mail is a method for exchanging messages that have been entered into a computer. Companies, such as MCI, Portal, and Compuserve, offer mailbox services. To use a mailbox service, participants log in to the remote computer to read or to send mail. For example, if George wants to send mail to Martha, George first logs in to the remote system, creates the mail messages, then logs out. Later, when Martha decides to read her mail, she logs in and discovers she has mail from George. Mail messages remain stored on the remote system until the recipient chooses to check for mail (see figure).

UNIX electronic mail generally uses the UUCP system (or SMTP) for transport and offers a *store-and-forward* service. In a store-and-forward service, local mail gets delivered immediately to a local user's mailbox. Mail to users at non-local (remote) sites gets stored until contact is made with the remote site, when it is forwarded to the remote site. The remote site then puts the mail in the user's mailbox. Once mail has been delivered to a mailbox, the local user uses a mail program, such as **`mail`**, **`mailx`**, or **`Mail`** , to read and respond to the mail.

As an example, I recently sent a re-

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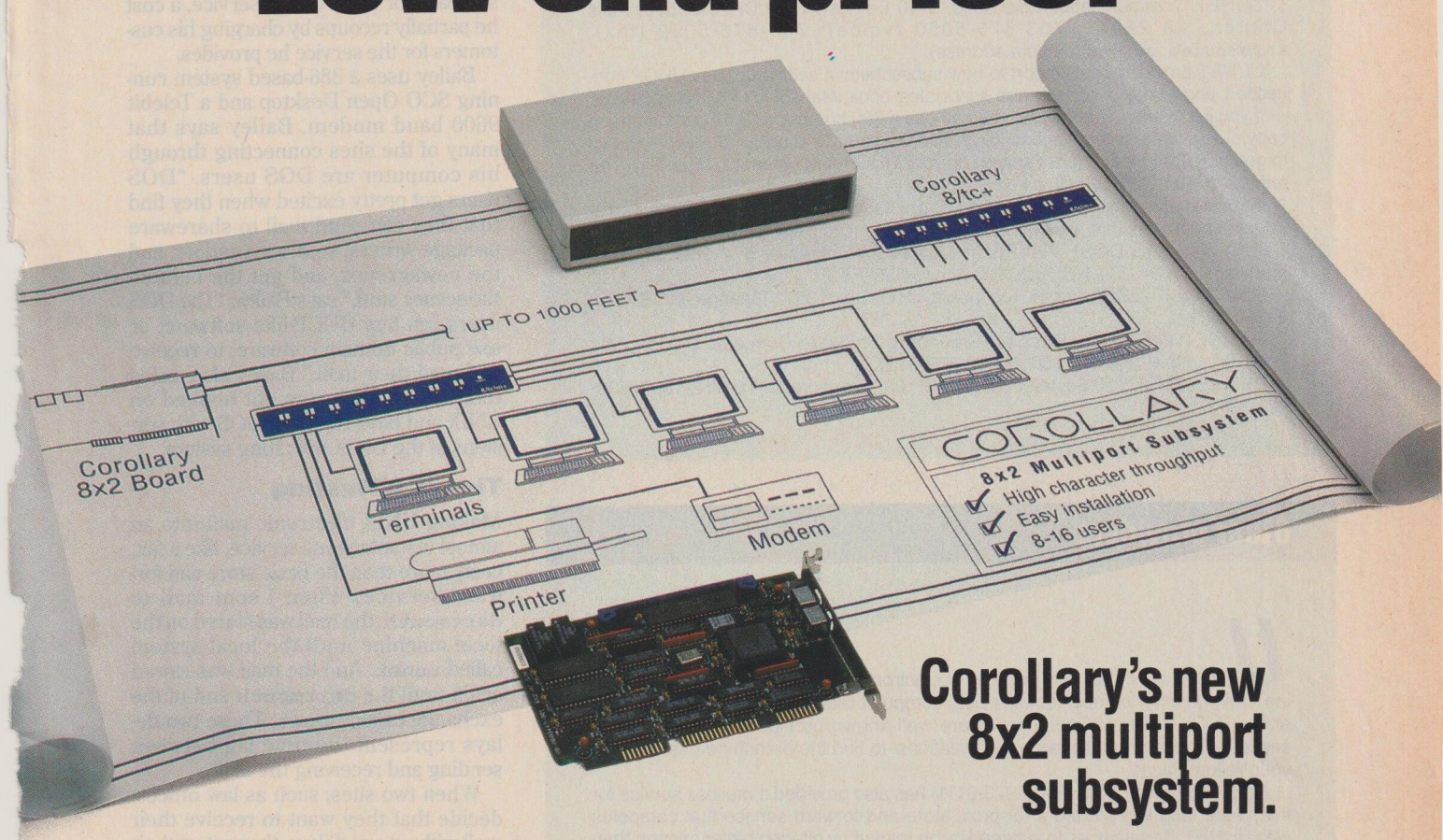

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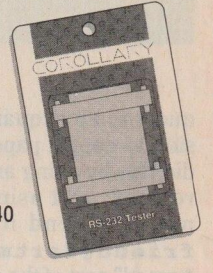

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CIRCLE NO. 95 ON INQUIRY CARD

Sign me up!

UUNET Communications Services asks that you fill out a subscription form before you can use the system for mail and news. To get a copy of this form call, write, fax (or e-mail!) to:

UUNET Communications Services, 3110 Fairview Park Dr., Ste. 570, Falls Church, VA 22042; 703-876-5050 (voice); 703-876-5059 (fax); **info@uunet.uu.net** (domain address).

UUNET provides free support to new subscribers in setting up their UUCP connection, and a copy of O'Reilly and Associates' book, *Managing UUCP and Usenet.*

If you just want free software, you can use a 900 number, at $.40 per minute, to copy out software without subscribing. Use the command **uucp uunet!~/help** to get more information (after setting up your UUCP **Systems** or **L.sys** file). The number is 900-GOT-SRCS.

If you have a computer that runs VMS or DOS, don't despair. Here is a partial listing of packages that allow DOS or VMS systems to participate:

UFGATE (MS-DOS), Tim Pozar Late Night Software, 671 28th St., San Francisco, CA 94131; 415-788-2022 or 415-695-7727.

UULINK (MS-DOS), Vortex Technology, P.O. Box 1323, Topanga, CA 90290; 213-390-3920.

RAMNET (MS-DOS), Ross M. Greenberg Software Concepts Design, 594 Third Ave., New York, NY 10016; 212-889-6431.

DECUS (VMS), 219 Boston Post Rd. (BP 02), Marlboro, MA 01752-1850; 508-480-3259. —*R.F.*

Other providers

UUNET is not the only provider of electronic mail and computer conferencing. Several other companies offer both computer mailboxes and various conferences. MCI Mail and Compuserve are well-known providers of mailbox-type services. These are nationwide organizations–to find the branch nearest you, try your Yellow Pages.

Portal Communications (408-973-9111) has also provided a mailbox service for five years, and has started a for-profit store-and-forward service that competes with UUNET. Portal hopes to succeed in the market by offering better support than UUNET; on the other hand, Portal is currently not as well-connected as UUNET. Besides Portal Communications, there are other groups starting to provide both local and national services.

Two other bulletin board and mailbox services bear mention. The Well is a popular, UNIX-based conference and mailbox system based in Sausalito, Calif. (415-332-4335). BIX is the conferencing and mailbox service run by *BYTE* magazine in Peterborough, N.H. (800-227-2983 or 603-924-7681). —*R.F.*

quest to an acquaintance for permission to copy a paper he had written. I did this by using an editor to write the request, and using this **mail** command to send it: **mail uunet! friend@dartmouth.edu**. The "uunet!" part of the address lets the local system know that this mail is destined for a remote system, **uunet**. The UUNET system generates the appropriate address for routing the message through the remaining sites. The "@" sign tells UUNET to determine the optimal path to the destination (see figure).

Before I sent my request, I knew that my friend could receive UNIX mail because he had given me his mail address. I did not worry about routing the mail to his site, because UUNET performs that work for me. In this case, his site contacts UUNET directly, but UUNET can also direct mail to other sites indirectly connected to UUNET.

For example, Mark Bailey, a consultant in Murfreesboro, Tenn., receives mail and news for many sites in middle-Tennessee. Other sites in the area call his computer, which forwards the stored mail to them. By acting as a local hub, only his site pays for the UUNET service, a cost he partially recoups by charging his customers for the service he provides.

Bailey uses a 386-based system running SCO Open Desktop and a Telebit 9600 baud modem. Bailey says that many of the sites connecting through his computer are DOS users. "DOS users get pretty excited when they find that they can send mail to shareware package writers, software vendors, and the newsgroups, and get the behind-the-scenes stuff," says Bailey. "The DOS users can buy UUCP-like software, or use public domain software, to receive and read their mail." Bailey also states that some DOS users got hooked on UNIX and have replaced DOS with versions of the UNIX operating system.

Time's A'Wasting

Making UNIX electronic mail into an almost instantaneous service, like a fax, costs more than the basic store-and-forward service. When I sent mail to **dartmouth**, the mail was stored on the local machine until the local system called **uunet**. And the mail was stored again until the **dartmouth** end of the exchange called **uunet**. These two delays represent the time lag between sending and receiving the mail.

When two sites, such as law offices, decide that they want to receive their mail without any delays, they set up their systems so that the UUNET site will be called immediately when a mail request has been made. Arrangements must also be made so that the UUNET computer will call the other law office immediately, instead of waiting to be called.

The instantaneous service costs more for several reasons. First, many sites wait until nighttime, when rates are lowest, to call UUNET. Putting off the call to UUNET has an added advantage, in that many messages can be transmitted during the single call. Having the UUNET site call out, instead of waiting to be called, also costs extra. Businesses that require this service will pay about twice as much as those who can afford to wait.

Pete Cottrell, the system manager of University of Maryland's Computer Sci-

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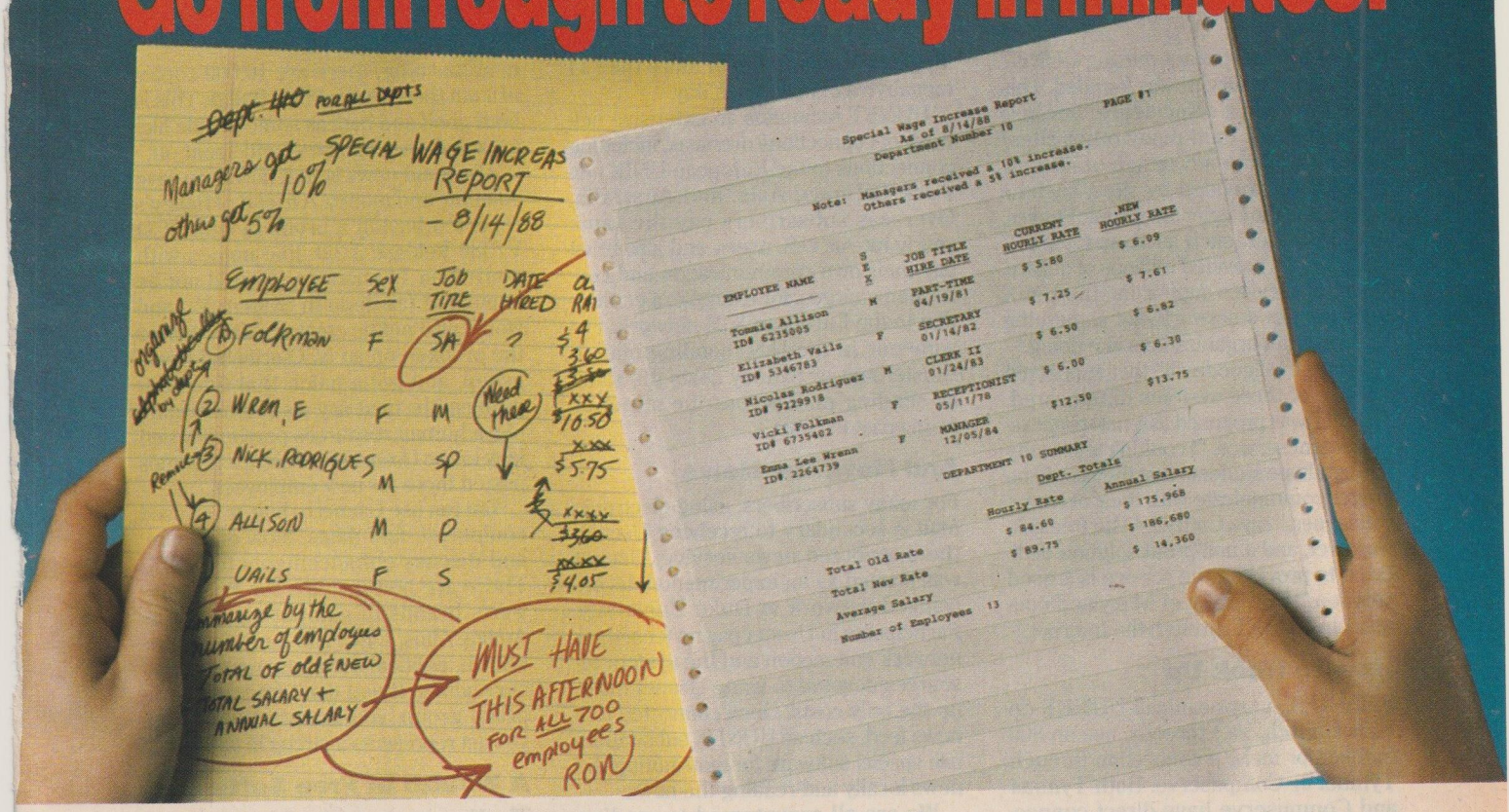

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CIRCLE NO. 129 ON INQUIRY CARD

ence department, started using UUNET right after the service was founded. This wasn't exactly a coincidence, because the university (and many other sites) had been taking advantage of international links provided by sites, such as **seismo**, at the Center for Seismic Studies, or AT&T sites, such as **ihnp4**. AT&T, for example, provided millions of dollars' worth of services supporting the UNIX mail and news network–not something that for-profit organizations like doing.

When the "good will" that supported the use of these systems disappeared, UUNET was proposed as a non-profit replacement service. "I couldn't tell faculty and graduate students that they could no longer communicate with their overseas colleagues," says Cottrell. "The free ride was over, and a non-profit solution dedicated to providing the service is a good solution." University of Maryland connects to UUNET through the Internet.

How to Hook Up

In the U.S., users can call UUNET (in Falls Church, Va.) directly, use an 800 number, or make a connection through Tymnet or Compuserve. Both Tymnet and Compuserve have direct connections to the UUNET system, so that calling a local Tymnet or Compuserve number permits connection to UUNET for the cost of a local phone call.

If you can't find an appropriate Usenet group, start your own

There are so many ways to connect to UUNET that deciding which way is the cheapest and most efficient can be confusing. Mark Bailey says he uses the 800 number because he gets a single bill from UUNET that consolidates the entire cost for the service. Companies with good WATS line rates can often call UUNET directly for less, while for many sites near large cities, calling through Compuserve or Tymnet is the best way to go.

Currently, all site subscribers pay a monthly rate equivalent to $35, plus a charge for connect time. One site that uses UUNET for mail only, and calls them via Compuserve at night, has a total bill of about $55 a month. A university that is receiving all the newsgroups and has a Telebit modem pays as much as $475 a month. This may seem high, but includes transmission of more than 11 megabytes of news each day.

UUNET maintains an extensive network of connections overseas, including connections to the European UNIX network (EUnet), Asia, and Australia. Overseas subscribers pay the same yearly rate as U.S. users, and also must pay their own communication and connection charges, for example, a connection to the European X.25 network. For someone in the U.S., sending mail to Amsterdam or Sydney costs the same as sending mail across the street or from coast to coast.

And Now, the News

For many subscribers, using electronic mail is secondary to receiving Usenet, the distributed news service. Usenet was started as an experimental decentralized network at Duke University. Participants in Usenet pay no fees–their network connection and the system resources devoted to using Usenet make up the only costs. Once connected to a news feed, such as UUNET, subscribers use special software for distributing the news locally and reading the news.

We are all accustomed to reading newspapers, but Usenet is something else. The news consists of postings to the net–notes, letters, diatribes, responses to other postings, freeware–anything a user wishes to submit. Reading just one day's news would be impossible without the utilities that have evolved to deal with news. Just as word processors were developed to edit text, the utilities for reading news have grown more powerful and easier to use. The original UNIX news software has been replaced by **vnews** and **readnews**. Other mail-reading tools, such as "C News" and **rn**, are also part of the public domain, and make pouring through news items easier.

Usenet is something like a distributed conference system. Users select the newsgroups that they are interested in, automatically limiting the amount of information they receive. When a user posts a news message, it gets forwarded throughout the network. It is an awesome connection. "You do something (post an item) in the evening, and the next morning, there are 10,000 copies of it out there," says Mark Bailey. This is both good and bad, as some people like to "stand on soapboxes" and spout off.

The good news is that news can save you time and money. A friend of Bailey's reported having a problem with SCO V/386 Release 3.2.0. File names with more than 14 characters would not be truncated (as done in System V), and would also not be created. Mark posted the problem on an SCO-oriented newsgroup, and got a patch that fixed the problem the next day. As another example, a human resources person learned how to use Usenet to peruse the resumés posted there for new employees.

You can use Usenet to buy or sell used equipment, find dates, blow off steam, and discuss enhancements to UNIX. There are newsgroups for PC shareware, brands of computers (such as Amiga, Altos, DEC, and Sun), fusion research, political theorists, realists, and surrealists. If you can't find an appropriate group, you can start your own. Usenet represents anarchy in action.

A Wealth of Free Software

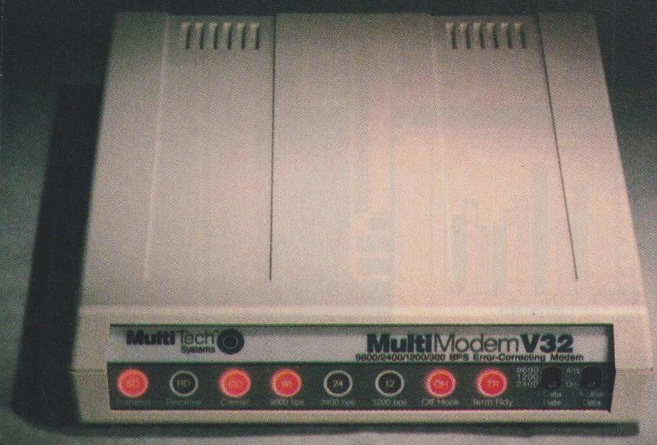
The Usenet community also posts copies of software for the public domain. This software is available free of charge to anyone, the only restriction being the resale of the software for profit. Freeware does have its drawbacks–it is distributed as source code, and often requires a knowledgeable user who can compile it and make it work. On the other hand, the freeware library is a tremendous resource. For the cost of the connection, you can download games, utilities, the source to many BSD-based UNIX commands, the GNU sources, communications packages, compilers, and more, totaling 50 megabytes of compressed source files.

For members of the insider community, this software has always been available. As Paul Vixie, a long-time user of Usenet and an employee of DEC, says, "UUNET makes it possible for people not in the know to be in the real world." UUNET dissolves more of the barriers between those who have used the UNIX system for many years and those who are just learning about it. The international communication and news enjoyed by a few has become available for the asking. ■

Rik Farrow is a software engineer, and author of a book on UNIX system security. He teaches courses on system administration and system security.

WHAT YOU SEE

WHAT YOU GET



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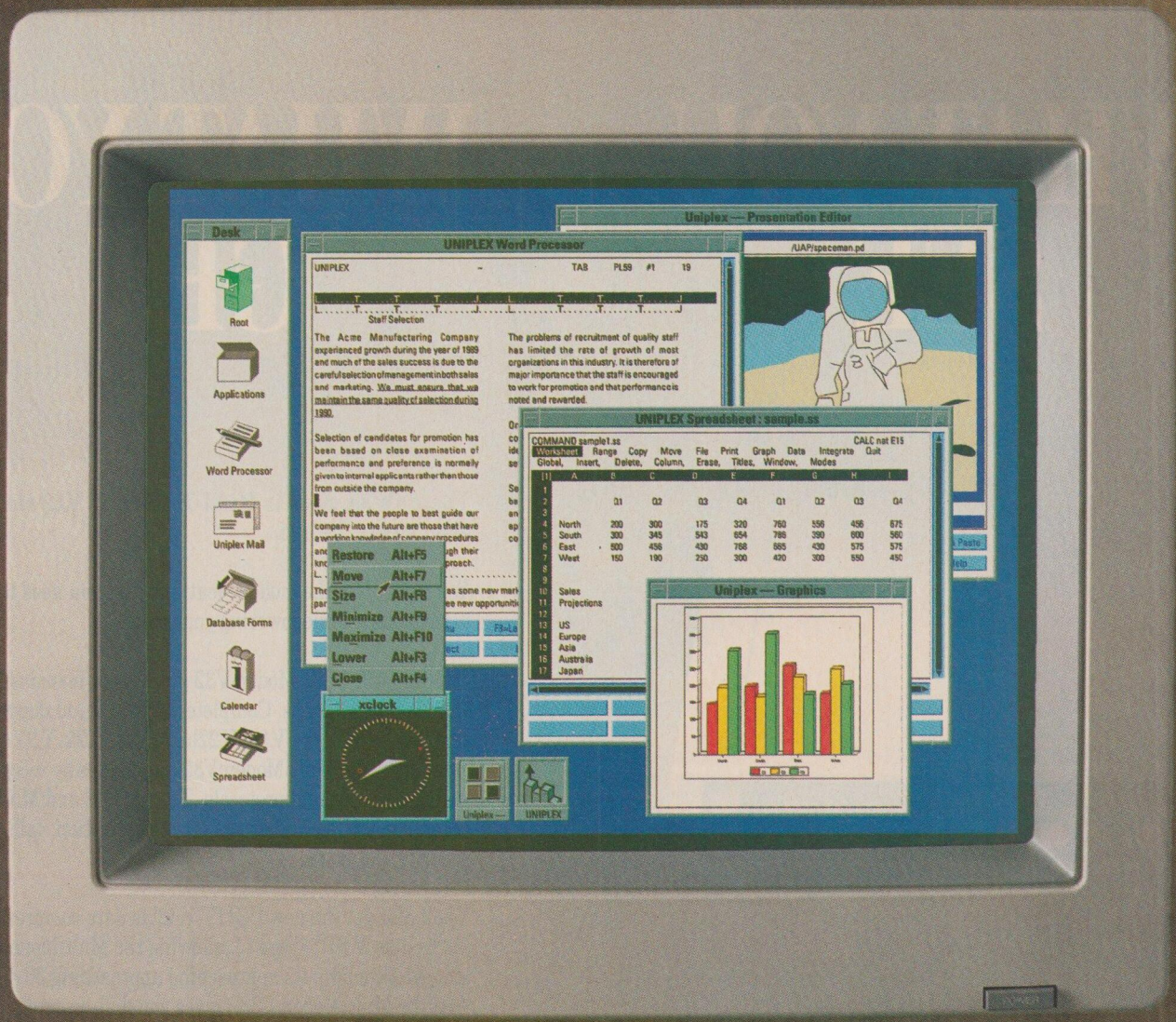

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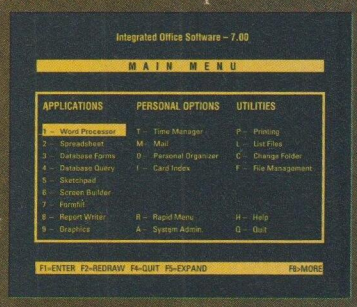

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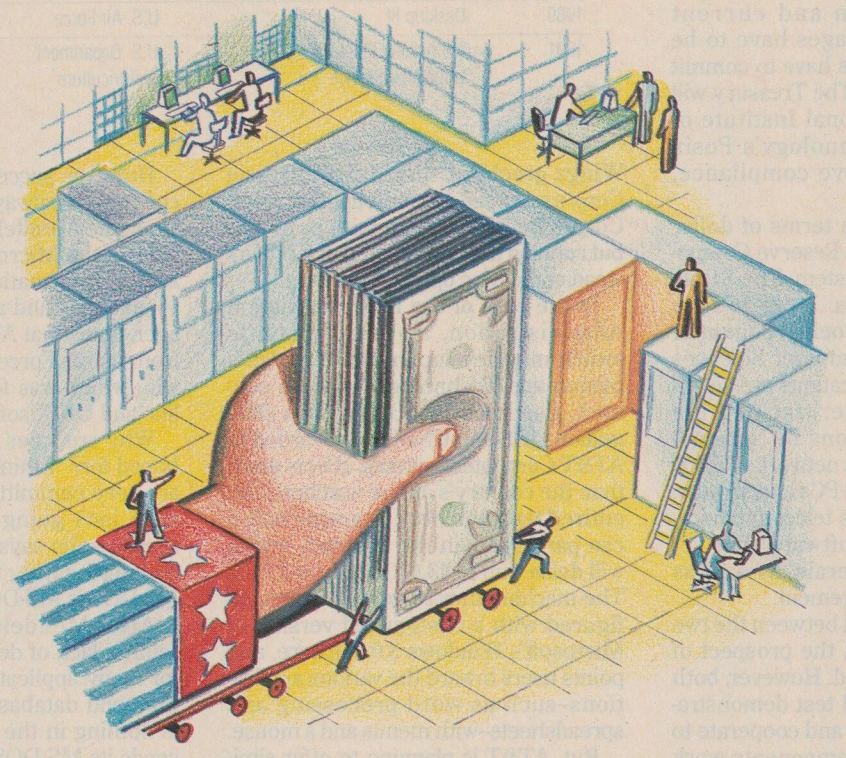
THE GROWING GOVERNMENT MARKET

THE FED'S TOP SIX UNIX CONTRACTS NEAR $6 BILLION



By Alan Jackson

An estimated $5.7 billion is on the line in the top six UNIX-related buys the federal government is making, but it's still uncertain whether UNIX is seen as a replacement for MS-DOS and older, proprietary systems, or just a Trojan Horse to meet Posix-compliant procurement regulations.

A Posix-compliant operating system is a must for a growing number of federal government computer purchases. Right now, Posix and UNIX are almost synonymous because UNIX was the first operating system that was Posix-compliant and is the most popular. That means the UNIX kernel has met certain criteria mandated by the IEEE.

And while the government specifies Posix as a way to get portability between applications, it now demands Open Systems Interconnection (OSI)-compliant networks in those procurements as well.

The federal government, with just over one million microcomputers on workers' desks and a hunger for more, is a truly open computer market, vendors are constantly told. However, that openness has its limits and its twisting trails.

One of the top six UNIX buys, the $700 million Air Force Desktop III award made in December 1989 to Unisys Corp., specifies both MS-DOS and Posix-compliant software. By late summer 1990, the Air Force said that unspecified problems with the Posix-compliant applications software had been cleared up, and the UNIX product was shipping to Desktop III buyers. The application in question was Enable OA, an integrated word processing, database, and spreadsheet program.

That's not the end of the story, however. A Michigan congressman whose district includes a Zenith Data Systems factory–ZDS was a losing bidder on Desktop III–had succeeded in getting the Defense Department's Inspector General to investigate the deal.

However, top federal agency managers are unwavering in their support for open systems–the government's favorite code word for UNIX.

"The trend is obviously toward interoperability," says Stephen W. Broadbent, deputy assistant secretary for information systems at the Treasury Department, at a recent seminar. The Treasury is the top dog in the UNIX buying business, framing its Treasury Microcomputer Acquisition Contract, or TMAC, as a $1.8 billion Posix buy. An award was expected in November

DAVID SUTER

1990, but delays have pushed that back.

Under the TMAC buy, which will span seven years, up to 3,220 UNIX multiuser systems, 49,000 PCs and servers, and 7,000 terminals will be purchased by the country's money masters, for use in agencies as diverse as the Secret Service and the Bureau of the Mint. Tasks will focus on office automation. AT&T Computer Systems, IBM Corp., and Lockheed Integration Solutions Company are expected bidders on the project.

Broadbent says there are several applications portability issues in the TMAC deal: there has to be a non-proprietary operating system, links between that system and current programming languages have to be available, and vendors have to commit to using those links. The Treasury will depend on the National Institute of Standards and Technology's Posix testing suite to prove compliance, Broadbent says.

Next on the list, in terms of dollar amount, is the Army's Reserve Component Authorization System. The $1 billion program was awarded in September 1990 to Boeing Computer Services Co. and Computer Sciences Corp. Here, the applications are somewhat more mundane: tracking the strength and locations of National Guard units through a network of 5,000 sites employing 28,000 PCs and servers. The price tag includes telecommunications networking, software (not yet named), and peripherals, as well as installation and management.

By splitting the deal between the two firms, observers say, the prospect of protests are minimized. However, both will have to pass field test demonstrations of their systems and cooperate to make sure the two components work together.

One of the more typical approaches is to combine UNIX capability with traditional operating systems, or substitute it for the old operating system. Apple Computer's A/UX 2.0 product, for example, runs on a Macintosh IIfx with typical Mac applications–graphics, word processing, CAD/CAM software.

Apple has already secured a commitment from the federal government. Through systems integrator Honeywell Federal Systems, Inc., Apple will supply a minimum of 10,000–and perhaps as many as 40,000–Mac IIx machines to the Air Force for its Worldwide Military Command and Control System ADP (automated data processing) Modernization (estimated $800 million). The Macs will be workstations on the network and are expected to run Informix Software Inc.'s Wingz graphical spreadsheet, Oracle Corp.'s relational database, and Microsoft Corp.'s PowerPoint graphics package–but running a secure version of A/UX instead of the Mac operating system.

The Top UNIX Procurement Contracts

Year Awarded	Procurement Contract	Department	Amount
1991	Treasury Microcomputer Acquisition Contract	U.S. Treasury Department	$1.8 billion
1990	Reserve Component Automation System	U.S. Army	$1 billion
1989	Office Automation and Technical Services	Federal Aviation Administration	$853 million
1989	Worldwide Military Command and Control System ADP Modernization	U.S. Air Force	$800 million
1989	Desktop III	U.S. Air Force	$700 million
1991	Animal and Plant Health Inspection Service	U.S. Department of Agriculture	$500 million

In the case of the Federal Aviation Administration, an equally subtle switch may develop in its Office Automation and Technology Services contract, also known as OATS. This $853 million DOS and UNIX buy, awarded to AT&T Computer Systems, affects more than the country's airline watchers: the entire Department of Transportation can participate in the contract, which will deliver up to 43,000 386-based PCs. The machine they're getting is preconfigured with a customized version of Microsoft's Windows 3.0 software, and points users toward the various applications–such as word processing and spreadsheets–with menus and a mouse.

But, AT&T is planning to offer similar capability on its Rhapsody UNIX software product, and FAA manager Gary Titsworth says the agency may look at Rhapsody for its needs. And whether it chooses Rhapsody or not, the UNIX capability is there.

One of the most promising open systems buys in the federal marketplace is coming from the Animal and Plant Health Inspection Service, or APHIS. It wants local- and wide-area networking to tie its sites together, where PCs, servers, and minicomputers will be installed. The glue will be a UNIX-based system; the price tag is estimated at $500 million. Applications will include data gathering and management reporting, and procurement officer Jack Palmieri says the deal could be expanded to "some other agencies" within the Agriculture Department.

However, success in the bidding process doesn't always translate into sales. Francine Mendelsohn, program manager of the Micro Technology Service at IDC Information Strategies Group, Vienna, Va., and a former federal manager, notes that AT&T "sold very little" from its Air Force AFCAC-251 contract win, which was for the 3B2 computer line and UNIX software.

Why are sales sometimes less than hoped for? "I think some organizations are very committed to UNIX, but MS-DOS isn't going to be overthrown," Mendelsohn says. "Recently, I've been quoting a saying that 'the successor to MS-DOS is MS-DOS.'"

Also, Mendelsohn says, "there's [still] a lack of decent UNIX software" for many applications. "Except for the high-end database applications, there is nothing in the UNIX world that exceeds its MS-DOS counterpart. [UNIX applications] just can't compare to DOS versions."

Moreover, "at the PC level, the UNIX hardware requirement is pretty extensive," Mendelsohn adds, noting that UNIX users of Desktop III PCs will need at least 4 megabytes of RAM and a 150-megabyte hard disk to run UNIX or MS-DOS, plus the better part of a workday to install UNIX.

Still, that's not keeping UNIX out of federal markets, even if it's just being bought to satisfy the Posix requirements in place. The open systems bids will continue to grow, although budget constraints may slow the pace. ■

Alan Jackson is a Washington, D.C.-based reporter who has covered technology in the nation's capital since 1986.

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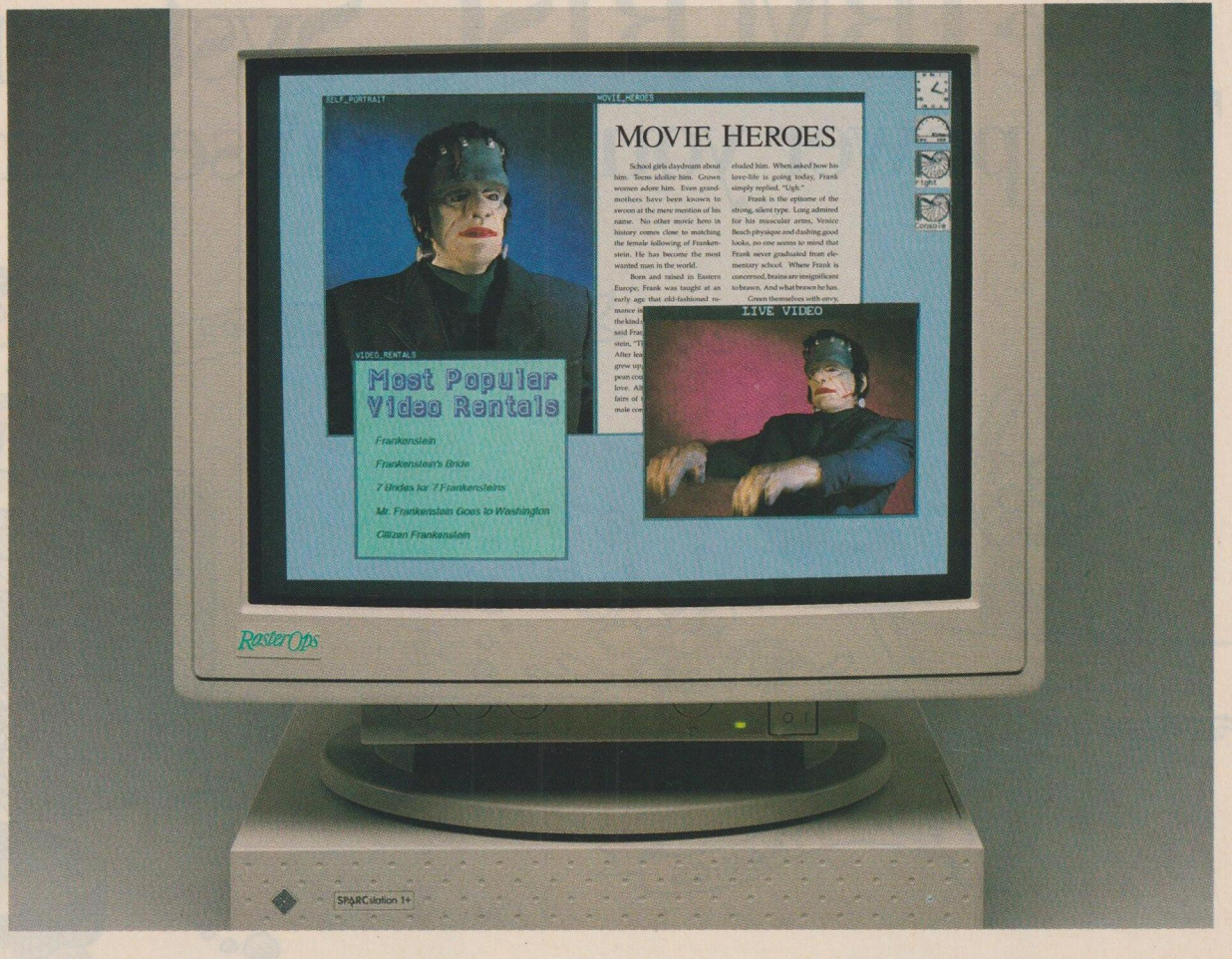

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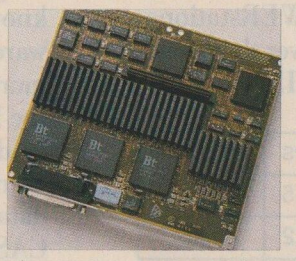

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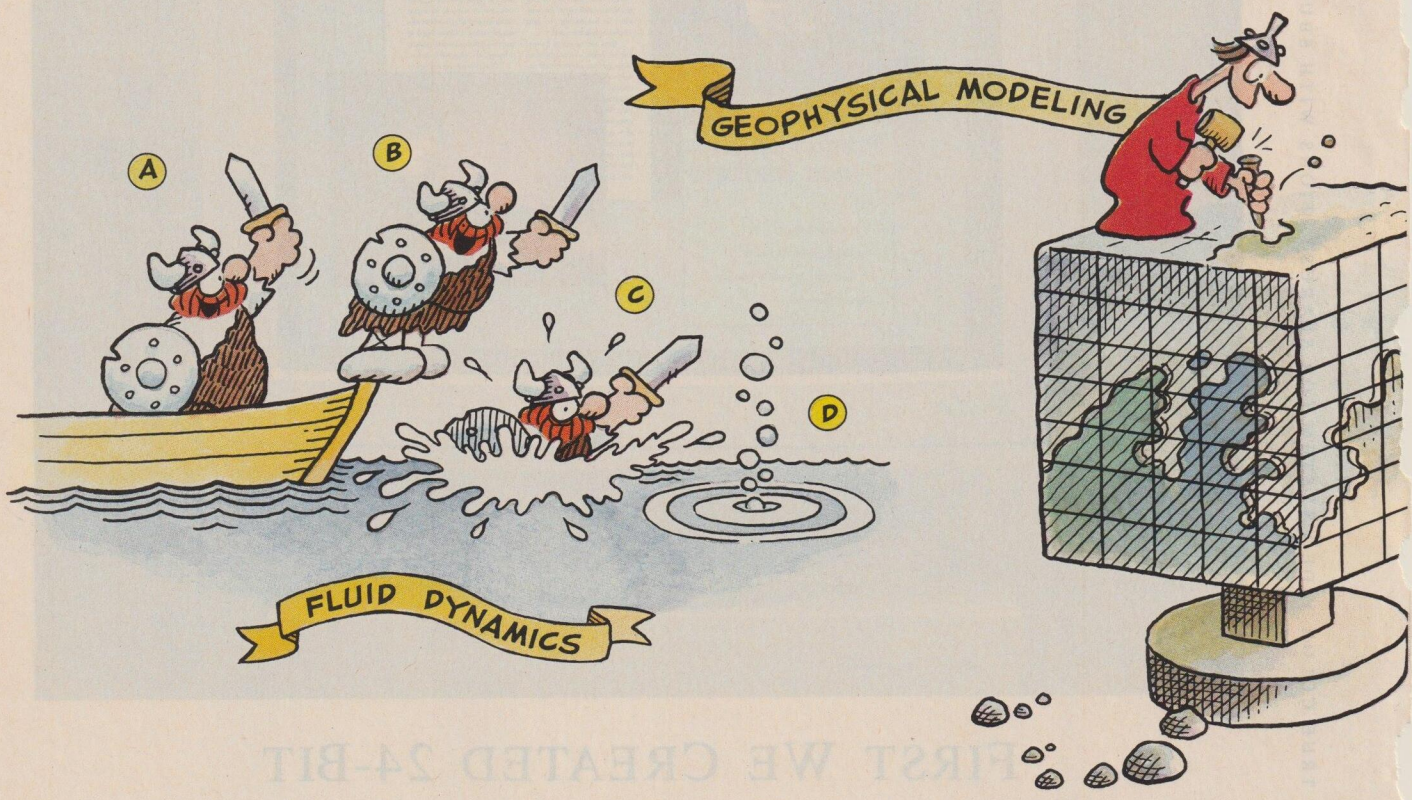

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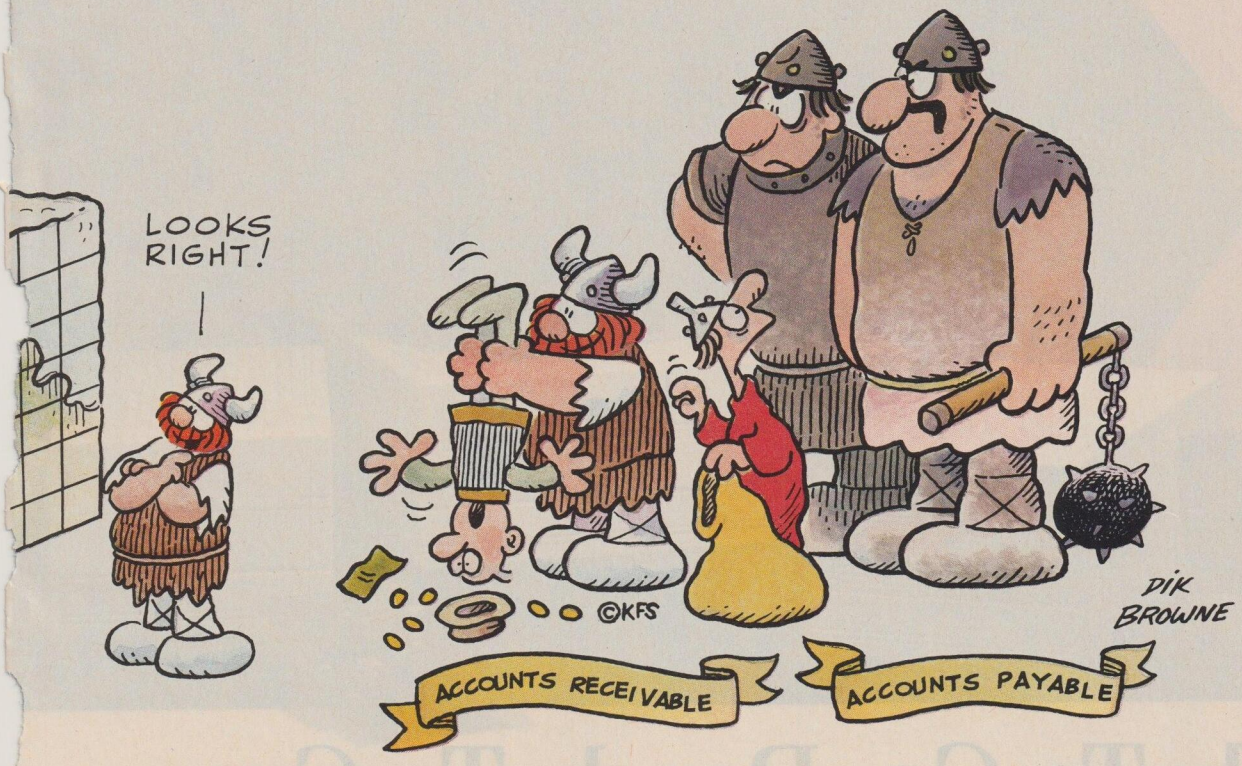

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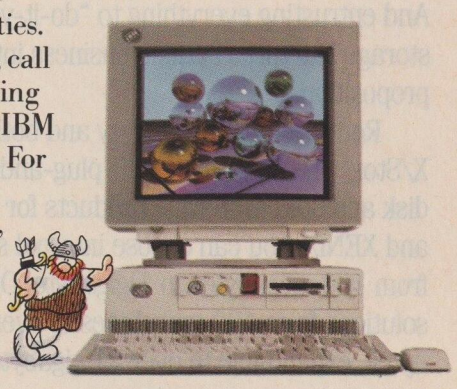

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CIRCLE NO. 252 ON INQUIRY CARD

Gentlemen, Start Your Disk Controllers

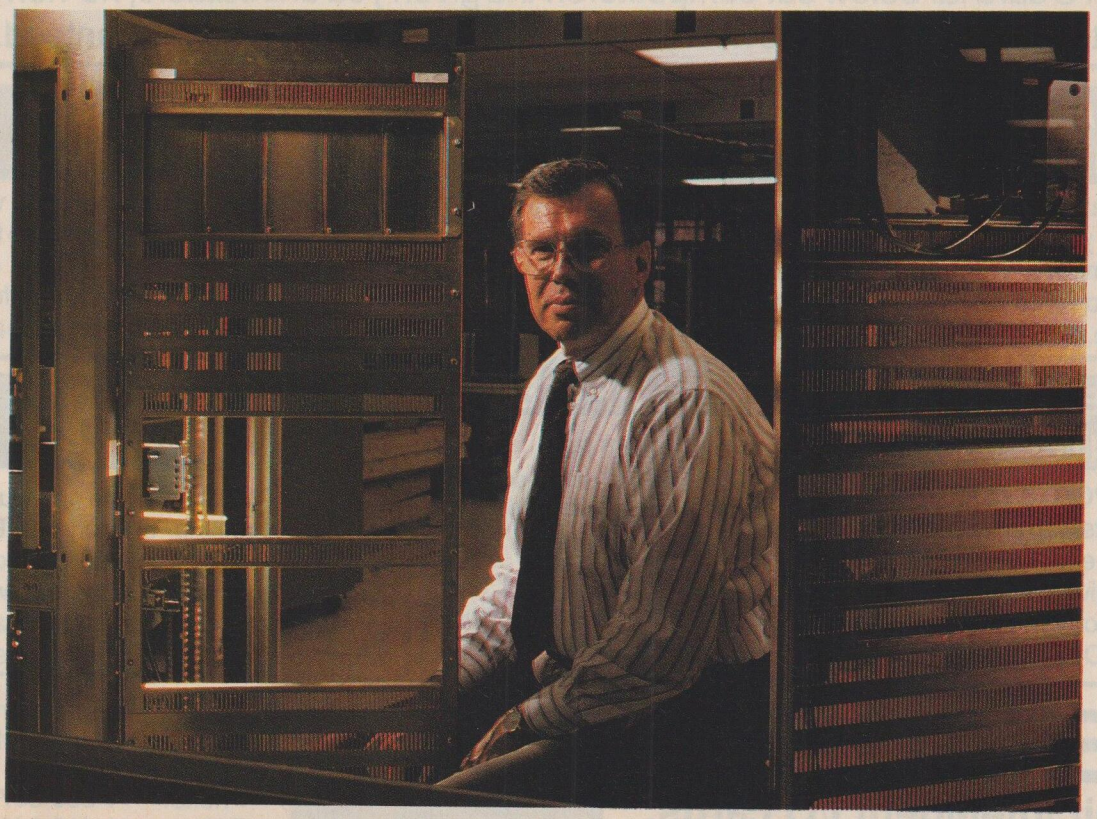
The right disk controller can rev up your system. Here's how to testdrive one

By Howard Baldwin

The way Eliot Ness went after bootleggers, Don Clapp goes after disk controllers. As a principal engineer for Sequoia, manufacturer of fault-tolerant minicomputers, Clapp makes sure that the disk controller works perfectly. He checks whether it transfers data from the disk to the CPU and back again. Why? You can have the fastest CPU on the planet, but if your disk controller isn't making a swift getaway, you'll be slowed down.

Eliot Ness would identify a bunch of suspects, round 'em up to check their stories, and hook 'em up to a lie detector. Clapp does the same thing. After compiling a list of suppliers and checking the specifications of VMEbus-based disk controllers, "we find out if they're in the same performance league we need. We bring in evaluation units, put them in a stock VME system we have, and see how they run," he explains.

After the benchmarking's done, he hooks the controllers up to a VMEbus fault detector, Clapp's version of a lie detector. It's a board that detects protocol



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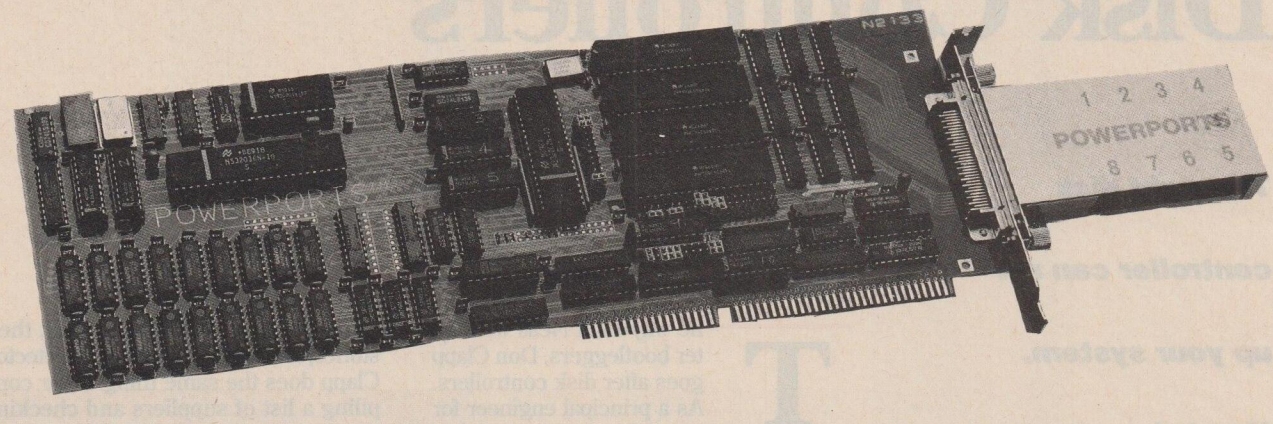

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violations. "There's a standard protocol to follow on the VMEbus," explains Clapp. He adds that in the name of increasing speed, vendors will make adjustments they shouldn't to make the card go faster, or not make adjustments that they should. "The fault detector makes sure everything is legal."

Do you need to deliver the third degree to the disk controller you might buy? It's a good idea, if you want the disk controller to deliver responsive performance in return. In the VMEbus-based world, you'll run across products from Xylogics, Interphase, and Ciprico, among others. In the AT bus-based world, there's an even wider selection of manufacturers, including Consensys, Perceptive Solutions, Distributed Processing Technology, and Mylex. Whether you're a manufacturer working on a full-blown system or an engineer devising a specialized in-house application, here are some clues from others who've picked up the trail.

This is Only a Test

Don Clapp's testing doesn't stop with the fault detector. His group has set up a test bed with about a dozen slots on it to run as many disk controllers as possible for the time and temperature test sequences. "We try to create the maximum amount of activity on the bus to see if anybody 'times out'." In most protocols, VME and SCSI included, boards have a certain amount of time to perform a task.

If, as Clapp says, "it gets lost or confused, that's a time out. We verify that under a full load we don't run into any time outs that are set too close together. Some controllers assume they have unlimited use of the bus, and that's a major mistake."

Clapp's temperature test is designed to identify problems before they appear. "We have an environmental specification of 104 degrees, because if it's 105 in the room, it's probably 110 inside the VME cage. So we take the boards and run them up another five degrees to see if they'll run." Sometimes, he notes, people don't turn off computers when the air conditioning goes off, and they wait until they "see the silicon dripping on the floor."

Jay Endsley, a research scientist for Kodak's Imaging Information Systems Research Labs (IISRL), strongly concurs with the idea of reconfirming numbers from the company–especially regarding speed. "The one thing that has the greatest potential for causing problems," says Endsley, "is the discrepancy between performance and what you see in the marketing literature." Many companies will quote a transfer rate near the top of the controller's capability. Typically, he says, that's a maximally configured system in the ideal conditions in the lab.

The key, according to Endsley, is to get your own controller, whether it is an evaluation board the company sends or one you buy on your own. Then "test it yourself and draw your own conclusions."

Endsley is working on a system that scans motion picture film at high resolutions into a Sun workstation, and can also record from the workstation back onto motion picture film. The largest images, he says, are about 40 megabytes per frame, or roughly two times the resolution of high-definition television (1920-by-1125). Like most disk controller buyers, Endsley was concerned with the speed. He wanted a controller that had a sustained transfer rate of 27 megabytes per second, but the issue of speed didn't exclude other criteria. "It had to be standard, and it had to be popular," he explains. He notes that, along with several others, both the ESDI and SMD standards have peaked, surpassed by SCSI and IPI.

"We found a controller that ran at 27 megabytes per second, but it used a proprietary bus interface, and the cost was higher," says Endsley. Ultimately, he chose Ciprico's 6600 parallel disk controller, a 32-bit SCSI-2 (wide SCSI) device.

Are We Compatible?

Make sure your disk controller not only works well with your application, but also that it will work with other devices in your system. Satellite Technologies Group (STG) has recently ported a satellite image processing software package that originated with the Army Civil Engineering Research Laboratories (CERL). In addition to speed, STG needed the capability for what CEO Eric Douthit calls "block-mode movement," which moves an entire image at once, rather than 25 percent at a time.

STG needed a disk controller that would work closely with its 32-bit video controller. It chose Perceptive Solutions' HyperStore-1600 controller. "The controller's speed, in conjunction with our 32-bit video controller, allowed us to do the block movement from the video board to the disk controller simultaneously and send the image directly to the screen," Douthit explains. "In English, that means we bypass the system memory and bring the image to the screen ten times faster." In this application, dealing with radar telemetry sent from NASA's Magellan probe, the images come to the screen in six minutes, as opposed to anywhere from a half-hour to several hours, according to Douthit.

The Customer Is Always Right

Even while IPI and SCSI controllers are becoming more popular, it's important to know where you'd use one and not the other. Tom Ruwart is system manager of graphics and visualization at the Army's High Performance Computer Research Center at the University of Minnesota in Minneapolis. In a similar scenario to the STG system, he is working on a way to transfer images from the disk to the screen, bypassing the overhead of the UNIX file system manager. His group is doing computational fluid dynamics research simulations on a Cray 2; an average simulation generates 500 files of 50 to 200 megabytes each. These massive files are stored on what Ruwart calls a "disk farm," and then shipped via a Xylogics' IPI controller into a Silicon Graphics workstation.

"The biggest bottleneck is getting the data into the system," says Ruwart. "It's an order of magnitude slower than the actual processing time." He chose the IPI controllers because they have higher bandwidth than the older SMD controllers. "IPI's better at doing large file I/O," he says. "Once you get the data going, it streams in very quickly." The

For More Information

Ciprico 2955 Xenium Ln., Plymouth, MN 55441; 612-559-2034
Consensys 250 Shields Ct., Unit 10-B, Markham, ON L3R 9W7; 416-940-2900
Distributed Processing Technology 140 Candace Dr., Maitland, FL 32751; 407-830-5522
Interphase 13800 Senlac, Dallas, TX 75234; 214-919-9000
Mylex 47650 Westinghouse Dr., Fremont, CA 94539; 415-683-4600
Perceptive Solutions 2700 Flora St., Dallas, TX 75201; 214-954-1774
Xylogics 53 Third Ave., Burlington, MA 01803; 617-272-8140

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other advantage, he says, is the one IPI controller can control up to 16 drives, while an SMD controller can only control four drives.

At Silicon Graphics itself, peripherals engineer Dan Scott adds a caveat for manufacturers who might buy disk controllers. "You have to know the direction your customer base is going," insists Scott. He says the way he's looked at disk controllers has changed "significantly" in the last 18 months.

"Our customers are dealing with large files, so sequential access was one of our primary performance criteria. But as we're getting into the server market, we were getting concerned with I/O per second, command overhead time, and what kind of queuing algorithms we can run." The result, according to Scott, was split: SCSI for the servers, where storage capability is more important than bandwidth; and IPI for the workstations, where the maximum bandwidth is important.

Working Together

Ultimately, according to several sources, important criteria of purchasing disk controllers have nothing to do with questions of technology. It's a question of a working relationship. Mark Bradley, I/O subsystems manager for Solbourne, highly recommends non-exclusive partnerships between systems houses and controller manufacturers.

"Developing a relationship that's engineer-to-engineer rather than vendor-to-customer tends to eliminate obstacles that can be placed there by business concerns," explains Bradley, adding that each group brings its own set of expertise to the table. "The systems houses don't know about CPU demands, and the controller houses are not necessarily involved in file system implementation and architecture." The end result: a reliable product that doesn't take years to integrate and debug.

The key, stresses Solbourne's Bradley, is *that* non-exclusivity, even while you're establishing a relationship. "There was no commitment at the beginning. Rather than having two engineers going down two paths, I had four engineers going down one path for 90 percent of the time."

Kris Swanson, manager of peripherals engineering for Concurrent Computer Corp., manufacturer of real-time minicomputers, adds that such relationships are as important at every phase of the process. "There's never been a device that we've integrated that hasn't had a bug. At the early stages, it could be your problem or theirs. You don't know about their [processes]–it's proprietary to them. You want to go with the company that will help you figure out whether it's your problem or theirs, and correct it quickly. The toughest bugs are the last ones you find."

Ultimately, then, the purchase of a disk controller is a two-stage investigation. Get a controller to evaluate, see how it works, and then talk to the manufacturers and see how they work. The best results will be flying colors for flying disk controllers. ■

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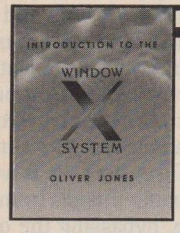
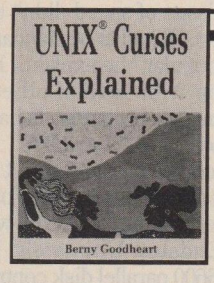


Introduction to the X Window System
Oliver Jones
1989, paper, 528 pp. 0-13-499997-5



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Berny Goodheart
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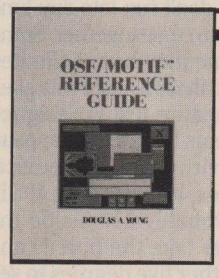

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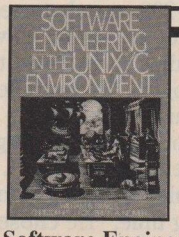
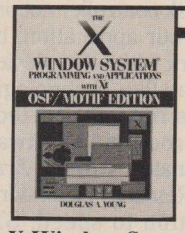
Douglas A. Young
1990, paper, 160 pp. 0-13-642786-3



Software Engineering in the UNIX/C Environment
William Frakes and Christopher J. Fox
1991, cloth, 288 pp. 0-13-829763-0



X Window System: Programming and Applications with XT (OSF/Motif Edition)
Douglas A. Young
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The X-Toolkit Cookbook
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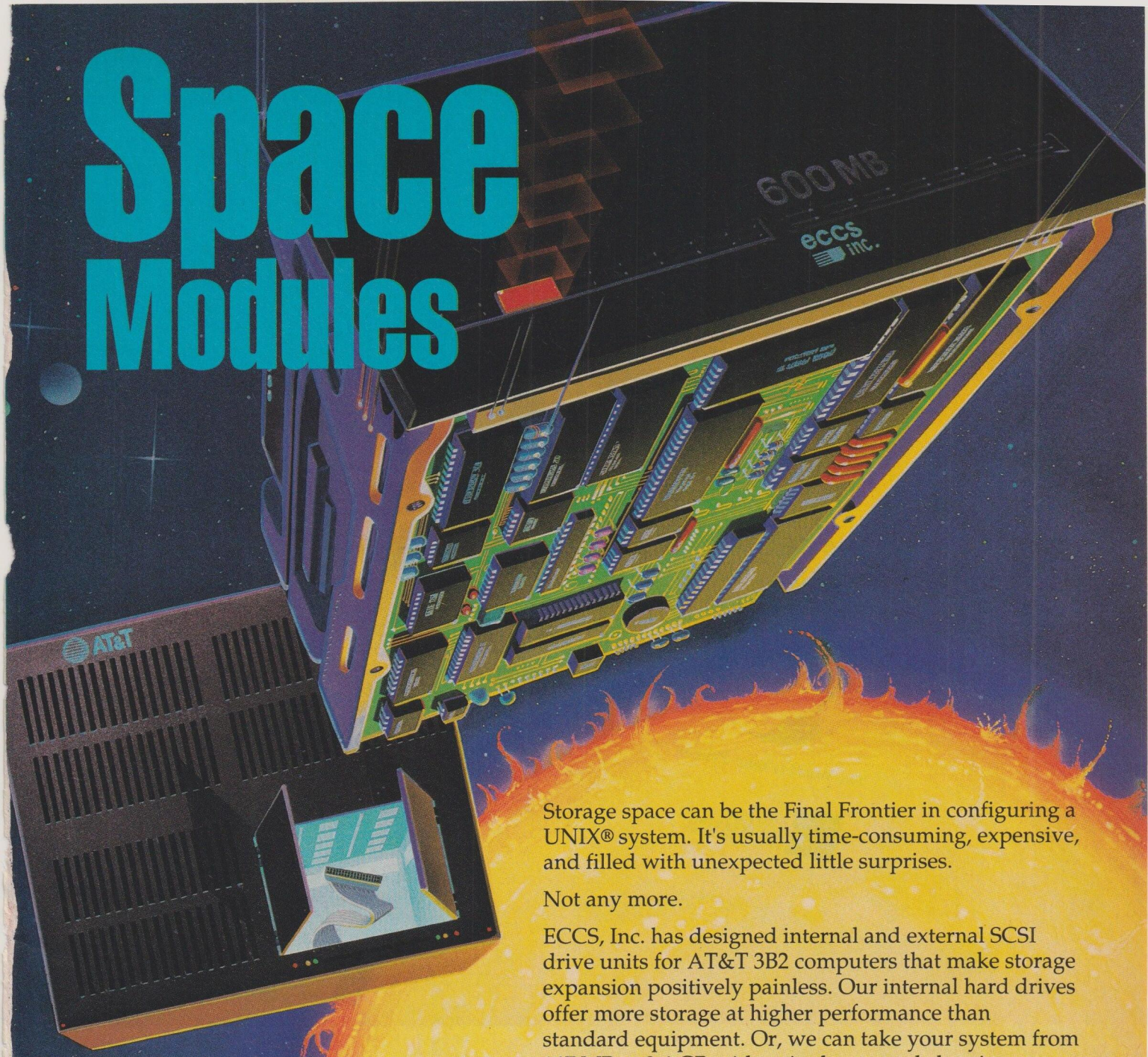

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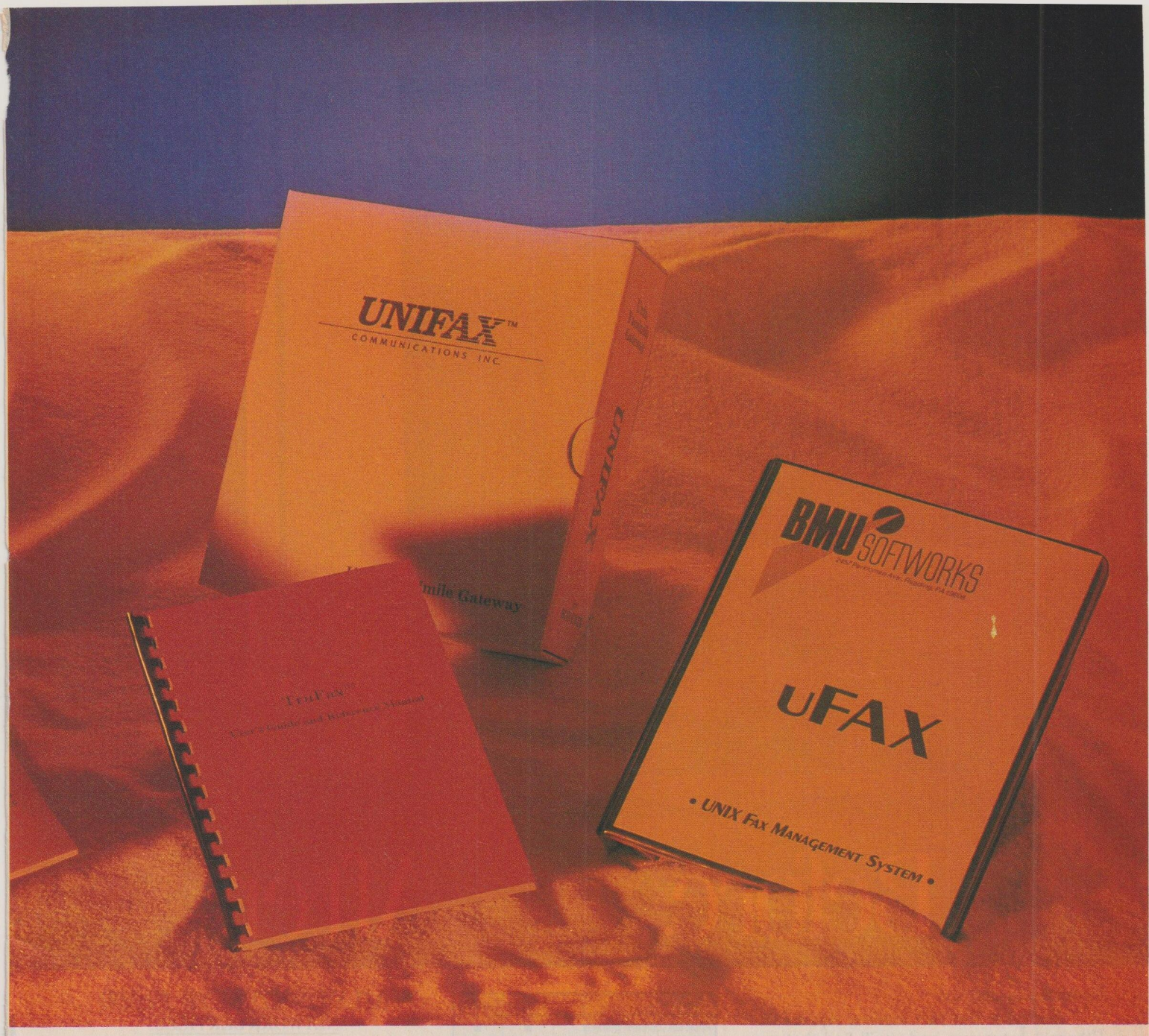
THE FAX SPEAK FOR

It took 149 years, but you now have lots of ways to send facsimiles from UNIX

Believe it or not, next year marks the sesquicentennial of Alexander Bain's 1842 invention of the facsimile. It wasn't until 1966, though, in one of the first examples of an industry consortium, Xerox and Magnavox created the specifications for what became the Group I fax standard. It was recognized by the CCITT, the Switzerland-based body responsible for international telecommunications standards. The Group III



THEMSELVES

BY HOWARD BALDWIN

standard, the one most machines support today, was adopted in 1980.

Besides a long history of dealing with standards-setting bodies, you might ask what else fax has in common with UNIX. The answer is twofold: on a general basis, fax products are designed to keep users dialing numbers at their desks instead of standing at a dedicated fax machine. Second, faxes work well with the multitasking world because fax transmission is inherently and ideally a background process.

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data delivered to it over some sort of wiring. You can install these fax-based hardware and software products either onto a host computer or onto your network, and access remote fax machines. By taking advantage of how pervasive fax machines have become, these products let you extend the outgoing reach of your electronic communications. Simply put, you can communicate by electronic mail to anyone who has a fax machine.

The Fax About Servers

Perhaps the one common link to all the UNIX-based fax solutions is the concept of a fax server. Just as a file server is a computer that is devoted to storing files, a fax server is a computer that is devoted to sending or receiving faxes. There are four facets to a fax server: host computer, fax boards, fax software, and a fax modem. Each component is designed for a specific purpose. For example, you can't just hook up any old modem, because what are known as the modulation schemes are different. While data modems adhere to the CCITT's V.22 or V.32 standards, fax modems adhere to the V.27 or V.29 specifications.

Brooktrout Technology's line of fax boards comes in three flavors: the AT-based TR112; the MicroChannel-based TR111MC, for either PS/2s or RS/6000s running AIX; and the TR112T1, for interfacing to T1 telecommunications lines. Brooktrout's boards are twin-channel boards, where a channel in the fax and telecommunications world is another word for line, as in your basic telephone line. Each channel represents one fax machine. You can also get the device drivers for TR112 for UNIX from The Santa Cruz Operation (SCO), AT&T, Interactive, and Sun.

You can communicate by e-mail to anyone who has a fax machine

Dialogic's Fax/120, on the other hand, has 12 channels on two boards. One is essentially a daughterboard to the other, but they take up two AT slots nonetheless. You can use Fax/120 in conjunction with Dialogic's D/12x voice processing boards, so that you can create a system that does voice or fax processing over any of the 12 channels at the same time. According to Dialogic, you can integrate voice and fax at the hardware and driver level, and direct a channel to automatically configure itself as either a voice channel or a fax channel. Like Brooktrout, Dialogic also offers a T1 interface.

The Fax About Software

When you start looking at UNIX-based fax software–the software that handles the communications between computer and fax machine–the line between what a system integrator would use and what an end user would use begins to blur. Naturally, if you're technically sophisticated, you won't be daunted by some of these packages' programming tools and utilities. These software-only solutions for the most part are PC-based applications, running with SCO's or Interactive's UNIX. They include BMU Softworks' uFax, COS's Trufax, Digiboard's Digifax, Faximum Software's Faximum, Plain English's Fax Toolkit, UniFax Communications' UniFax. One exception to the PC rule: Trufax software also runs on SPARCstations, IBM PS/2s and RS/6000s running AIX, and AT&T 3B2 minicomputers.

Although there are some exceptions, for the most part, these products let you then support up to eight fax cards. That means you have access to eight phone lines. You can send `troff` (UNIX text formatting) files, ASCII character files, TIFF (image formatting) files, or Group III standard fax files. You can schedule outgoing jobs on the basis of priority and time of transmission, and send files to one or more destinations by telephone number, name, or group name.

continued

For More Information

Fax Boards

Brooktrout Technology 144 Gould St., Needham, MA 02192; 617-449-4100

Dialogic 300 Littleton Rd., Parsippany, NJ 07054; 201-334-8450

Fax Software

BMU Softworks 2457 Perkiomen Ave., Reading, PA 19606; 215-779-0477

COS 9 Huron Way, Lawrenceville, NJ 08648; 609-771-6705

Digiboard 6751 Oxford St., Minneapolis, MN 55426; 612-922-8055

Faximum Software 1497 Marine Dr., Ste. 300, W. Vancouver, BC V7T 1B8; 604-925-3600

Open Systems Engineering P.O. Box 396, Granby, CT 06035; 203-653-0032

Plain English Computers 1925 46th Ave. #103, Capitola, CA 95010; 408-462-2869

UniFax Communications 6400 Roberts St., Ste. 492, Burnaby, BC V5G 4C9; 604-294-4300

Voxem 200 River Rd., Red Bank, NJ 07701; 201-576-1566

Fax Products

Computer Signal Corp. 2420 Camino Ramon, Ste. 225, San Ramon, CA 94583; 415-275-0990

DCE Corporation 50 Glenbrook Rd., Ste. 1A, Stamford, CT 06902; 203-359-5737

Fax Group 12625 High Bluff Dr., Ste. 111, San Diego, CA 92130; 619-792-6400

Frontier Technologies 3510 N. Oakland Ave., Milwaukee, WI 53211; 414-964-8689

Perfect Byte 7121 Cass St., Omaha, NE 68132; 402-554-1122

V-Systems 39 Brookhollow Dr., Santa Ana, CA 92705; 714-545-6442

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You'll also be notified by electronic mail as to the success or failure of the transmission. Many of the packages let you define the components of the cover sheet, and log activity to keep track of who's sending what to whom.

The Fax About The Database

There are a couple of exceptions to the previously listed software packages. One is Open Systems Engineering's (OSE) Fax-Press, which comes with an external fax modem that plugs into the RS-232 serial port on the UNIX host.

Products integrating boards and software are increasingly available

Using Fax-Press, you can create an interface that works with WordPerfect Office for UNIX, Uniplex's integrated office software, and UNIX's own UUCP electronic mail. OSE's Fax-Press Distribution System has similar links to any of the Big Four UNIX databases: Informix, Ingres, Oracle, or Sybase.

The software's FaxMerge capability can be used to input a "boilerplate" text–a standard format that allows you to fill in the blanks. The blanks, of course, are the variables from your database that change in correlation to the product and purchase, such as price, catalog number, shipping address, and quantity. You can then program the fax server to poll the database for this information, and then replace the variables with the appropriate information. What rolls out of the fax machines are forms with the blanks filled in.

The other exception is Voxem's SoftFax software. It's strictly software, and strictly for the VAR or OEM. As with Fax-Press, you can create interfaces into other software packages, but it's also device-independent; i.e., it supports the CCITT Group III, TIFF, Posix, and C-ISAM formats, and lets you make the decision as to the internal fax board or external fax modem to be used. SoftFax also gives you a library of format conversion tools.

The Fax For The End User

Your opportunities for finding the boards and software already integrated as products are increasing rapidly. The line between strictly OEM (original equipment manufacturer) products and end-user products blurs here too, though. For instance, Perfect Byte's FAXmodem 9600 product includes both an external modem that plugs into the serial port of a Sun-4 workstation, and its PerfectFAX software, which provides the communications capability. You can also get a developer's kit and technical assistance from Perfect Byte for integration of the product with other software applications.

In addition to converting ASCII files, you can also use FAXmodem 9600 to convert PostScript and Sun raster files to facsimiles. As with many of the PC-based products, UNIX mail can be used to send faxes and include a customized cover sheet with company logo and signature.

V-Systems' VSI*FAX system works the same way as Perfect Byte's. Its external SX-200 fax modem connects to the host computer's serial port. Hosts in V-Systems' case include UNIX-based PCs as well as the AT&T 3B2, NCR Tower, HP 9000, and other machines from Sequent, Pyramid, IBM, Unisys, Arix, Sun, Texas Instruments, and Encore. You can use the VSI*FAX memo option to compose your cover sheet.

When you're attaching a fax modem to a serial port, you're only limited by the number of serial ports. There is one serial port per fax line. To get more, add an expansion board of RS-232 serial ports. In this case, you've really dedicated the host as a fax server, because board real estate in workstations is usually so expensive. Computer Signal Corporation's (CSC) CorporateFax product is based on UniFax Communications' software, and runs on SPARCstation, Aviion, or Motorola-based CISC or RISC workstations, or UNIX-based PCs. It works this way by turning the host into a fax server. You can also get a site license corresponding to that same number of phone lines (1, 2, 4, 8, 16, or 32).

Many of the PC-based products offload the fax processing onto an intelligent board. The external fax modem products, however, frequently do the imaging. They transform the graphics from its digitized form into the kind of image that would be generated by a fax machine. It happens in the host server because the process is compute-intensive. They leave the modem to handle the communications or "handshaking" responsibilities. You can access CorporateFax through either a Motif interface or a command-line interface.

Other fax server products include Frontier Technologies' 16-line LAN Fax gateway for TCP/IP networks, which requires an IBM workstation or PC. Running in its initial release on AIX and encompassing ISA (Industry Standard Architecture) or MicroChannel boards and fax software, the LAN Fax allows you to monitor transmissions, availability, and usage using SNMP, the simple network management protocol. LAN Fax also offers direct inward dial (DID) support as an option.

DID support provides the capability of sending faxes between computers. While this may seem redundant to electronic mail, with DID support, you can route faxes to a particular user's computer via the user's network address. You can also send images as faxes in reduced-byte format. DID support comes on DCE Corporation's FaxBox, a standalone device that links to the host via the serial port.

CSC's CorporateFax product turns the host into a fax server

On a more complex level, there's the Fax Group's Multipro System 210. It combines a Bull DPX/2 Model 210 PC running UNIX, performing mailbox, billing, routing, storage, and retrieval functions, with a peripheral 386-based box that provides up to 64 fax ports. Running in the peripheral computer is the software and hardware that translates the data formats, and handles voice prompt-

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ing and annotations if you have boards with voice processing chips. You can connect the Multipro system to mainframes or public data networks via X.25 and TCP/IP over Ethernet; you can also configure it as a gateway for X.400 electronic mail while it's acting as a fax server.

Just The Fax

In addition to applications that any company might employ, there is also a great deal of interest in UNIX-based fax products from the regional Bell companies (RBOCs). Their interest stems from the fact that they don't make any money when you get a busy signal. The RBOC will route the fax to a fax server in its own facility, store it on the fax server's disk, and send it on to the destination fax as a local call when the line is free.

Besides the RBOCs, you may also see applications from service bureaus who could maintain DID numbers, so that both the programming costs and the capacity of the system can be amortized over multiple customers of the service bureau. The fax cards from Brooktrout and Dialogic with voice processing chips on them open up possibilities in toll-free and 900-number request lines. The voice chips allow you to program the cards with simple instructions. A potential customer could call your company for information on a variety of products ("press one for information about widgets"), and then punch in a fax number. In a few minutes, the data sheet on widgets could be coming out of the fax machine.

Companies will continue to capitalize on the fax-with-UNIX option

The plethora of fax products is just one more way in which the world of computers and the world of telecommunications are coming together to make both computing and communication easier. As time goes on, companies will continue to capitalize on the pervasiveness of fax machines and UNIX to send information on its appointed rounds faster and easier. ■

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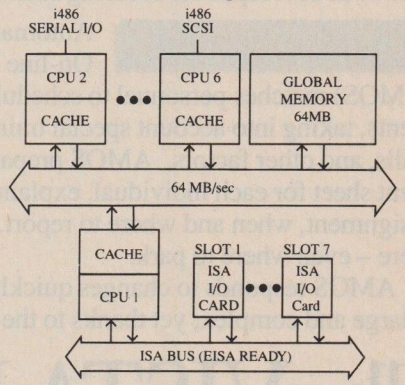
applicationDEC 433MP System Block Diagram



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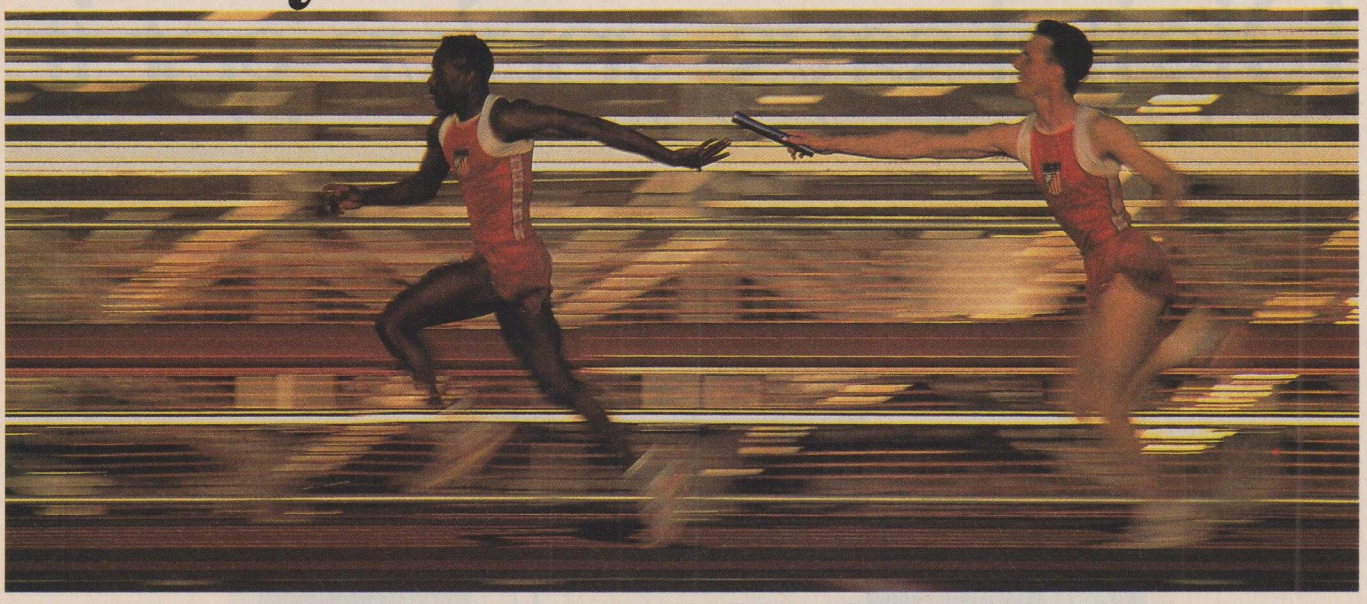
DBMS Case Study:

Security for the Goodwill Games™*



The Problem The 1990 Goodwill Games: 2500 athletes in 22 events at 15 locations, drawing hundreds of thousands to watch them perform. A show-place for international goodwill. A potential target for terrorists. A challenge for security agencies.

With only 3,000 off-duty officers to fill 30,000 assignments, there's no room for confusion in scheduling. And scheduling must respond to last minute changes, as event times slip, as dignitaries arrive on short notice, or as threats arise. Hand-scheduling can't meet the challenge. But the Games' Integrated Police Planning Group (IPPG) found that no automated system had ever been developed for securing such events.

The Application Automated Manpower On-line Scheduling (AMOS) matches personnel to scheduling requirements, taking into account special training, language skills, and other factors. AMOS prepares an assignment sheet for each individual, explaining the assignment, when and where to report, how to get there – even where to park.

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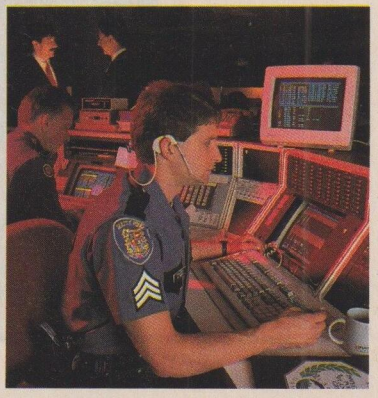

Command center personnel can adjust schedules without delay or confusion, thanks to db_VISTA III's ability to handle large volumes of data with speed and accuracy.

The Solution

AMOS was created by Raima's services subsidiary, Vista Development Corp., using the db_VISTA III DBMS. "We looked for months for a database that was fast, flexible, and could handle a huge volume of data while still maintaining speed," said Sgt. Alan Bernstein of the IPPG. "We also wanted to find a company that could not only furnish the product, but provide the development services." They discovered Raima and db_VISTA III.

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UW021

CIRCLE NO. 90 ON INQUIRY CARD

DELL SLAYS THE UNIX BEAST

By Rick Farris

Combine plug-and-play boxes with remote system administration and you get the Dell Station

The era of mail-order UNIX is here. DOS mail-order kingpin, Dell Computer, believes small businesses and corporate departments are ready for its X Windows-based Dell Station package. What the company offers is a 486 host, one or more 386SXs to act as X terminals (but run DOS as well), and a bigger selection of software than in Open Desktop from The Santa Cruz Operation.

The Dell Station is an ambitious undertaking. And by emphasizing DOS connectivity, Dell is saying in a loud and clear voice that the Dell Station marks the trail into UNIX. This leaves me to ruminate about unskilled DOS users up against the UNIX beast–although it might not be that horrible, if Dell's software support and remote administration programs are a success. To be sure, it's a better bet that Dell will be in business longer than a local retailer who promises in-person service.

Dell installs both system and application software at the factory. This gives businesses a fair chance of putting the Dell Station to work in a single day, after connecting the hardware components and running thin Ethernet cables. In case your hard disk crashes at some point in the process, Dell includes a backup tape to try to restore the disk. If you run into other problems, Dell's support may get you over the hump (or you'll get a replacement system by express service).

The Dell Station is not inexpensive. Loaded, which it should be, a 25-MHz 486 host can cost up to $16,700 with a 16-inch monitor. Add to the package

ROSE HODGES

For mail-order aficionados, the Dell Station offers a 486 host with UNIX pre-installed, and a software support and remote administration program for UNIX novices.

three 386SX systems with VGA color monitors–dubbed Dell Partners–and the price jumps another $10,000. From a do-it-yourself perspective–which is a valid perspective when talking mail order–you could probably put a similar four-seat package together for $12,000 or $13,000.

The do-it-yourself price doesn't include the software. And this, coupled with the $2,175 per year fee for remote system administration, really brings value to the Dell Station. The software bundle resembles SCO's Open Desktop but tops it by including Uniplex's office automation software. The rest of the bundle consists of Interactive 386/ix, X Windows, Motif, X.desktop, TCP/IP, PC-Xsight, and PC-Interface. Uniplex includes a word processor, spreadsheet, business graphics, and relational database. If you prefer only software support, instead of remote administration, Dell provides this alternative on a per-user fee schedule. The first year of the software plan is included in the purchase price. Typical annual renewal fees are $599 for one user, $899 for four users, and $2,099 for 32 users.

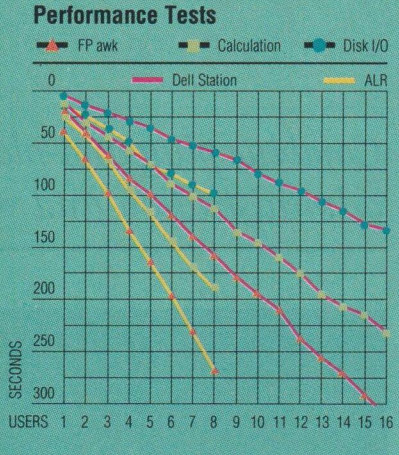
The UNIXWORLD/ Neal Nelson Benchmark shows the kind of performance you would expect from a 486 platform

As tested, the EISA-bus Dell Station 425E had 16 megabytes of system memory, a 330-megabyte hard drive, a Wangtek tape drive, a 5 1/4-inch floppy drive, an Ethernet adapter, a GPD 16C high-resolution (1024-by-768) monitor, and a GPX-1024 graphics accelerator. Dell also supplied two Dell Partners for testing, a 286 model 210 and a 386SX model 316SX. Both Partners came with optional floating-point co-processors, 4 megabytes of system memory, 40-megabyte hard disks, VGA monitors, and Ethernet cards. In addition, Dell says it has begun shipping a 33-MHz version of the Dell Station host. This sells for $2,000 more than the 25-MHz 486 host.

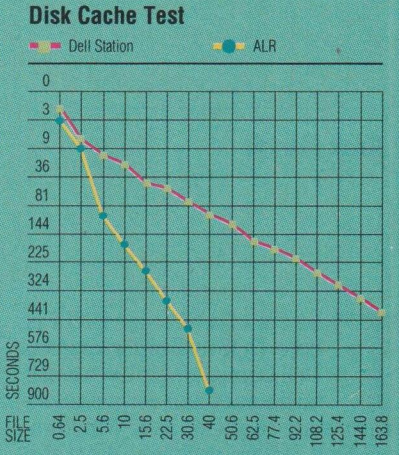
I ran into one glitch during installation. The Dell Station wasn't configured to automatically start up the Partner interface software, so it took me a while to peruse manuals. As an experienced system administrator, I had no trouble locating the relevant information, but I think a UNIX novice would have been sunk. To be fair, Dell's literature only claims that the Dell Station itself is preconfigured.

No Surprises with Dell Station

The Dell Station 486 system performs as you would expect–faster than the 33-MHz ALR FlexCache (the reference system), but about the same as other standard 25-MHz 486 systems. Overall, the Dell Station outperformed the ALR FlexCache in all test categories and fared much better in disk cache tests.



The Dell Station, as tested, supported a 486 processor running at 25 MHz. The system was configured with Interactive UNIX 386/ix, 16 megabytes of memory, an EISA bus, and a 330-megabyte hard disk.



The 386 ALR test system ran SCO XENIX 2.3.2 at 33 MHz and supported 15 megabytes of system memory, a 180-megabyte ESDI hard drive, and an 80387 math co-processor.

A Complete System

The UNIXWORLD/Neal Nelson Benchmark shows the kind of performance you'd expect from a 486 platform (see benchmark). The benchmarks can't convey the snappiness of the total Dell package, however. The fast 14-millisecond disk drive combined with the graphics accelerator card make for no-wait computing.

I usually work on a 33-MHz 386 with a Super VGA card, and the Dell feels much quicker. A task like loading Emacs may take 10 to 15 seconds on my 386; the same job is accomplished in about half the time on the Dell Station. The X Windows performance of the GPX-1024 card is staggering compared to VGA. With six windows open and active, performance was still acceptable. I could drag windows smoothly across the screen while directory listings showed only slight jerkiness.

The Dell Station host comes in a standard PC-sized desktop case. When I removed the cover to inspect the insides, I found a sturdy PC–in addition to heavy braces and two fans, it included copper fingers around the mating surfaces for the lid. Despite the additional metal, the Dell Station and Partners have a Class A FCC rating.

The 16 megabytes of main system RAM on the motherboard reduces the need to frequently access disk, but when necessary, access is lightning-quick. The speed is due to the combination of the Micropolis 14-ms, 15-MHz hard drive, and the Ultrastore 12F ESDI controller. The Ultrastore is rapidly gaining recognition as one of the faster and more reliable ESDI controllers. Its on-board 32-kilobyte track-cache quickens access to contiguous data, allowing 1:1 interleave on the hard drive.

In the system package, Dell includes an internal Wangtek 5150 tape backup unit, capable of 250-megabyte backups using DC6250 tapes. The Dell documentation indicates that the standard UNIX backup programs should be used for backup, but strangely enough, Dell includes a copy of the DOS `Sytos`

UNIX WORLD BLEW IT!

Dear UNIX WORLD Readers,

Ki Research has taken this full page ad in order to respond to a recent article in UNIX WORLD which dealt with Terminal Servers titled "Linking Terminals on Ethernet". If you believe what UNIX WORLD said, you stand to lose a lot of money in terms of lost CPU and network bandwidth as well as overall productivity.

UNIX WORLD MISLED THEIR READERS

UNIX WORLD would have you believe that only DEC machines speak LAT and UNIX machines speak only TCP/IP. They would have you believe that TCP/IP and LAT are equals. They are wrong on both counts.

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- LAT Host Services is a single daemon. TCP/IP has multiple daemons. The single LAT Host daemon greatly reduces CPU utilization.

- LAT is a highly specialized protocol which minimizes network bandwidth and CPU utilization. TCP/IP Terminal Servers use a generalized protocol noted for its high network overhead and CPU utilization.

- LAT has load balancing which allows users to login into the most responsive systems. TCP/IP Terminal Servers do not have load balancing.

- LAT has automatic fail over in the likelihood that one of the UNIX systems defined within a service name goes down.

  TCP/IP Terminal Servers do not have automatic failover.

UNIX WORLD DID NOT GIVE THEIR READERS THE FACTS

UNIX WORLD represented that LAT royalties drive up the cost of a LAT Terminal Server.

The facts are most of the current LAT Terminal Servers are not intending to pay DEC a royalty for their reverse engineered products. In fact, the price per LAT port is going down especially when sold without TCP/IP option. Another fact UNIX WORLD chose not to recognize is that many Terminal Server vendors know LAT is a superior protocol but chose to develop TCP/IP as a market distinction over DEC's Terminal Servers. The fact is that TCP/IP cannot do the job LAT can. The end user will, and has, paid a high price for some slick marketing.

UNIX WORLD INCORRECTLY RAISES THE PROPRIETARY BUGABOO

UNIX WORLD implies that Terminal Server vendors are building TCP/IP Terminal Servers because LAT is proprietary and expensive. This just is not so. The LAT protocol is licensed much the same way that UNIX is licensed. The fact is the LAT protocol spec is readily available for a very small fee.

We believe UNIX WORLD has done a great disservice to its readers by not making them aware of the availability of LAT on 40 plus UNIX platforms and by implying that only DEC has LAT on its hosts.

UNIX WORLD you blew it. Please own up to your mistakes.

Ki Research Inc. 301 553 0181 800 544 8352

CIRCLE NO. 46 ON INQUIRY CARD

backup program. I like Dell's policy of including the complete system software, as shipped, on backup tape. Theoretically, this means if you have catastrophic setup problems–like a disk drive damaged in transit–a simple restore would have you up and running after replacement of the defective drive.

Hey Partner

The review Dell Partner occupies a case about twice the size of a pizza box. The small case can fit but one floppy drive, so ensure that you can live with either 5 1/4- or 3 1/2-inch media. You can't have them both. The small cases were welcome on my crowded desktop.

A couple of days after the first Partner arrived, the keyboard quit working. I tried to replace it with a spare keyboard, but I was surprised to find

With an all-in-one package like Uniplex, Dell avoids third-party software administration headaches

that Dell's miniature case also had a miniature keyboard connector, which thwarted my effort. I called technical support at 4 p.m. (PST) and received a replacement keyboard via Airborne Express the next morning. That's exemplary service. In the box with the replacement keyboard was a return pre-paid shipping label. Dell swears I received no special treatment as a reviewer.

The Dell Partners use TCP/IP for both PC-Xsight and standard PC-Interface connections to the Dell Station. PC-Xsight provides X terminal emulation support for the Partners, using Rational's DOS Extender to access all 4 megabytes of system RAM. The emulation software (usually referred to as the X-server) supports X.desktop on the Partner's 14-inch monitor. With resolutions of 640-by-480 (VGA) or 800-by-600 (Super VGA), desktop aesthetics take a hit, but performance is fine.

Logging in to a server with the PC-Interface Host File Services makes the server file system appear as the next available drive letter on your Partner. This means if you have drives `C:` and `D:` on your Partner, and you log in to the Dell Station, its file system becomes drive `E:`. Of course, PC-Interface must map UNIX's 14 character names to DOS's 11 character names, so a utility is provided to show both versions in a directory listing. Accessing the server in this fashion resembles the structure of a traditional DOS LAN, with no remote-job-execution facilities and no X Windows.

DOS and UNIX

With UNIX, networking, DOS emulation, X Windows, Motif, and X.desktop, the Dell Station includes a comprehensive set of system software. Dell provides automated setup and a complement of system administration scripts, driven by the **sysadm** program, but this is still a full-fledged operating system.

There is no way that this system could be maintained by a non-technical end user, however. Almost anyone could get it set up–perhaps with help from technical support at Dell–but every UNIX system needs administration. Even DOS LANs require some administration, and they are considerably less complicated than the UNIX operating system.

By including VP/ix with the Dell Station software, Dell has helped pave the rocky road from DOS to UNIX. VP/ix provides DOS emulation so that must-have DOS programs can be run while UNIX replacements are being acquired and learned. Novices will love to use VP/ix to run Xtree so they can learn their way around the UNIX file system.

DOS users access Uniplex using PC-Xsight; if they don't need the services of Uniplex they can access files on the Dell Station using the PC-Interface Host File Services. Finally, the Partner user can execute simple commands like checking disk space or doing a directory listing of the hard disk on the Dell Station by using the **on** utility.

Software Sombrero

The X.desktop interface, which sits on top of Motif, makes the Dell Station easy to use. Double-click on a file icon and its application automatically starts. Drag an icon from one directory to another to move a file. Double-click on an icon to open a new directory window. If you hanker for the command line, open an **xterm** window.

By including an all-in-one package like Uniplex, Dell has avoided some of the system administration headaches associated with installing third-party software. The Uniplex spreadsheet has a 1-2-3-like interface, with added mouse support for moving around the screen and for menu selection. Under the **Integrate** menu selection, access is provided to the Uniplex clipboard, database services, and desktop utilities, and includes the ability to run a UNIX command and paste the output into the spreadsheet. At any rate, if you're familiar with 1-2-3, you'll soon be at home with the Uniplex spreadsheet.

The Uniplex word processor is a full-featured text processing package with a Lotus-like menu interface. Under X, the display is somewhat WYSIWYG, but

REVIEW HIGHLIGHTS

Dell Station & Partners
Dell Computer Corp.
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Austin, TX 78759-7299
512-338-4400
800-678-8649

Excellent overall performance, superior support, good DOS-UNIX connectivity.

Too high a level of bundling–office automation should be optional. Price is high.

Price: *Dell Station 425E with 16 megabytes of RAM, 16-inch color monitor, GX256 graphics accelerator, 330-megabyte ESDI hard drive, 1.2-megabyte floppy, 250-megabyte tape drive, Ethernet card, mouse, Dell Station software: $16,634. Dell 210 with 4 megabytes of RAM, Super VGA monitor, 40-megabyte hard drive, 1.2-megabyte floppy, math co-processor, Ethernet card, mouse, MS-DOS, Partner software: $3,507. Dell 316SX with 4 megabytes RAM, Super VGA monitor, 40-megabyte hard drive, 1.2-megabyte floppy, math co-processor, Ethernet card, MS-DOS, mouse, Partner software: $3,616.*
Support: *7 a.m. to 10 p.m. (EST), Monday through Friday; 10 a.m. to 6 p.m. (EST), Saturday. Toll-free number.*
Warranty: *One-year Xerox on-site for hardware, one-year phone support for software. 30-day unconditional guarantee.*

some effects come out better than others. For instance, when selecting "large" letters, they are indeed larger than the others, but they occupy the same amount of horizontal space, so they overlap.

The Uniplex database manager is Informix 2.10. Informix holds a significant share (23 percent, according to a 1990 IDC poll) of the UNIX database market, and Uniplex did well to select it. Informix has all the necessary database features like interactive SQL, transaction commit and rollback, and a forms designer. Uniplex's value-added portion includes the X interface and the link from the Uniplex spreadsheet to the Uniplex database.

Uniplex's business graphics package let me enter numerical data and see it graphed in quite a range of formats. The presentation editor, on the other hand, is a general-purpose draw program of limited ability. The only tools provided are for drawing lines, boxes, arcs, circles, polygons, and text. Modern draw programs would supply bezier curves and numerous text effects not found here.

The $2,175 for system administration software is a good deal, considering its claim to do most everything

Practically Speaking

When the dust settles on the Dell Station, I think small businesses and corporate workgroups will appreciate the value added by Dell. Perhaps Dell should give you the option of unbundling Uniplex. Personally, I would prefer to spend the money adding preferred applications such as WordPerfect and Access 20/20–although, to resurrect a phrase, Uniplex is a turnkey solution.

As for system administration, if you don't have a clue, you're a prime candidate for Dell's remote administration program. The $2,175 for this package is a good deal, considering Dell says it will do most everything and only balk at becoming deeply involved in connecting the Dell Station to other networks at your site. The per CPU price includes the basic software support plan, which covers both system software and Uniplex.

So Dell has all the basics covered. Well, not quite. Dell admits that at least one person at each Dell Station site will have to become a little more technical than other users. But this person only needs to venture as far as is necessary to communicate with the Dell support people. The upside to this is the person might get so technical that you never have to renew the software support or remote administration–which would put you into UNIX for real. ■

Rick Farris is a software designer and freelance writer working with firms in and around San Diego. He can be reached on the Internet as `rfarris@rfenger.com`.

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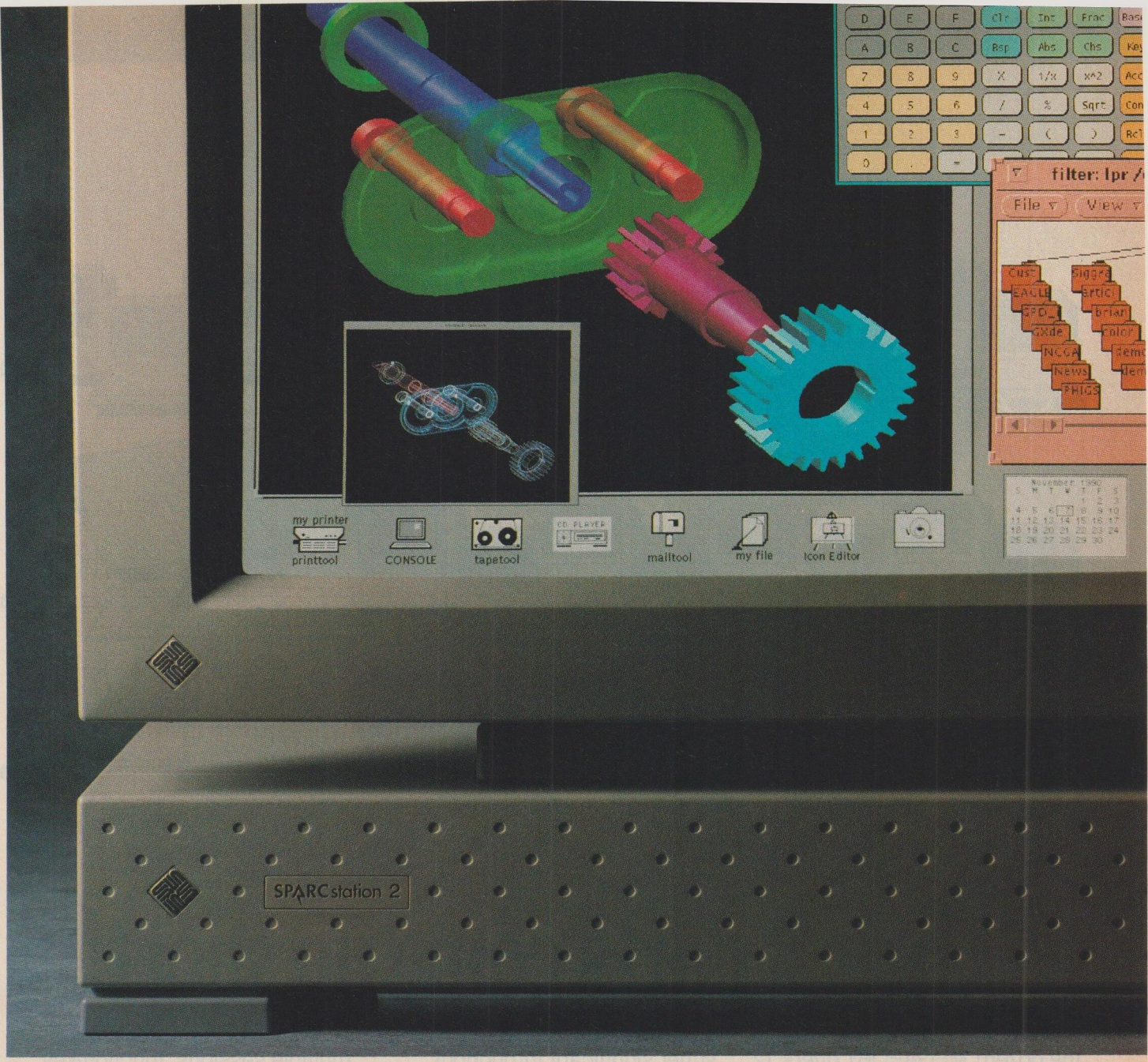

you create 3-D solid images in 24-bit true color. It's the kind of machine you hate to share. And from now on, you won't have to.

At the high end, there's SPARCstation 2GT. It does all the above, but it's been tuned especially for PHIGS, which is the highest standard for 3-D graphics on the planet. So it runs five times faster than the GS. With all this, it gives you a level of image quality you've never seen at anywhere close to its price.

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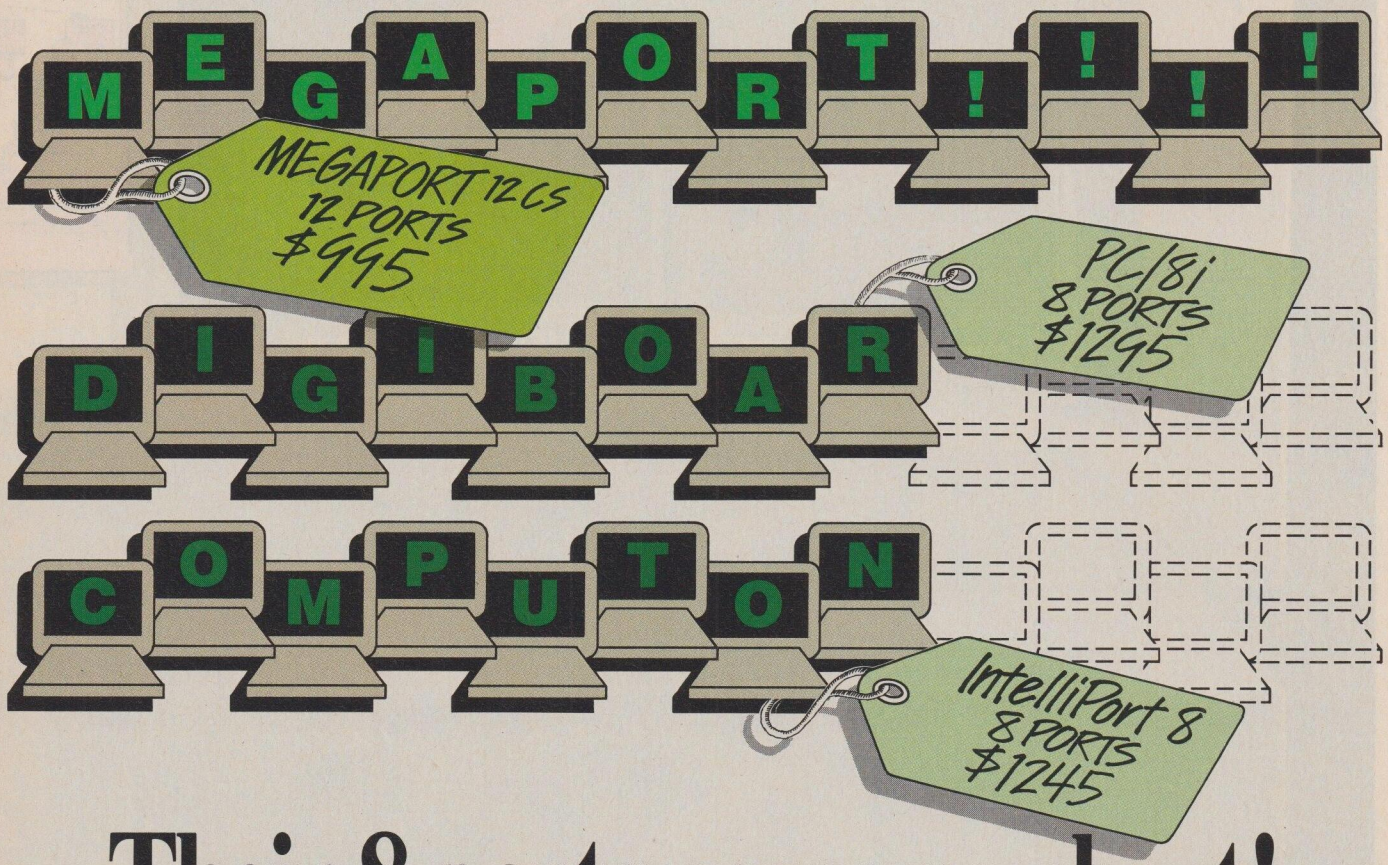

Their 8 ports come up short!

It's true that ports are better by the dozen! MEGAPORT offers 12 ports for a lower cost than their 8-port boards; *and* our 24-port model is less expensive than their 16-port boards. Buying our 12- or 24-port board is like getting 50% more ports for free—giving your system room to grow at no additional cost!

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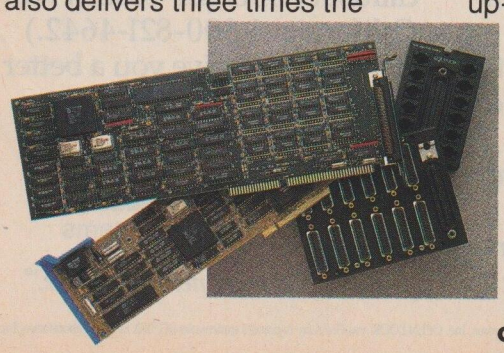
And MEGAPORT is the only serial I/O board with "soft" set-up—no dip switches, no straps and no programming of interrupts, I/O addresses or DMA channels.



Drivers are included at no extra cost for all the popular versions of System V UNIX, XENIX and IBM's AIX. They provide everything you demand from a premium multi-user board, including transparent print, multiple sessions, function-key remap and more.

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CIRCLE NO. 210 ON INQUIRY CARD

NEW UNIX VARIANT FOR $99.95

By Harry Avant

Coherent from the Mark Williams Co. aims for DOS power users and UNIX trainers

What is one-third the size of AT&T's UNIX, one-tenth its cost, installs in 20 minutes, requires 7 megabytes of disk space, and supports multitasking and multiple users? The answer is Coherent, a look-alike UNIX system that has pundits and reviewers asking: Does anyone really need or want a $99.95 clone of UNIX?

Vendor Mark Williams Co. thinks so. It thinks DOS power users are curious at the hobbyist level, and companies and schools are interested in Coherent as a training tool. I think Mark Williams' mail-order marketing and 20-minute installation procedure will attract DOS hackers who are bored with the `C:>` prompt. I also think that it is a sensible training tool. But I'm not a pundit.

One thing to get straight is that Coherent is not real UNIX. It is a simulation of UNIX, based on AT&T's System V Release 2. It offers most utilities found in real UNIX (see table), but ignores modern issues such as Posix compliancy, the X Window System, and network file systems. In fact, if you want to plug a Coherent box into an NFS (Network File System) network–a reasonable thing to expect–you can work in terminal mode, but you'll need to port the NFS code yourself.

Coherent has some good uses other than training. The most obvious one is as a UUCP node. Another is to use it for **troff** printing and thereby free more expensive systems. Another is for learning shell script and C programming, although for the latter, a DOS user is better advised to use Borland's low-priced Turbo C. Coherent's C compiler does not support medium and large memory models, but Mark Williams Co. does supply an assembly language compiler (designed for subroutines only), **lex**, **yacc**, and the **db** debugger.

Training is Coherent's biggest plus. I can see Coherent being used to teach introductory programming, but I can also see companies using Coherent in "New to UNIX" training courses, because of its low-price per seat (about $1,200 with a moderately equipped

Commands in Coherent

The following table of Coherent commands is a representative list of commands found in `/bin`.

[	ac	ar	as	at	awk
bad	banner	basename	bc	c	cal
calendar	cat	cc	check	chgrp	chmod
chown	cmp	col	comm	compress	conv
cp	cpdir	crypt	date	db	dc
dcheck	dd	deroff	df	diff	diff3
dos	du	dump	dumpdate	dumpdir	echo
ed	egrep	epson	expr	factor	false
file	find	fixstack	fnkey	from	grep
head	help	hp	hpr	hpskip	icheck
join	kill	lc	ld	learn	lex
ln	login	look	lpr	lpskip	ls
m4	mail	make	man	mesg	mkdir
mount	msg	msgs	mv	ncheck	newgrp
nm	nroff	od	passwd	phone	pr
prep	prof	ps	pwd	quot	ranlib
restor	rev	rm	rmail	rmdir	sa
scat	sed	sh	shutdown	size	sleep
sort	spell	split	strings	strip	stty
su	sum	sync	tail	tar	tee
test	time	touch	tr	troff	true
tsort	tty	typo	umount	uncompress	uniq
units	wc	who	write	yacc	yes
zcat					

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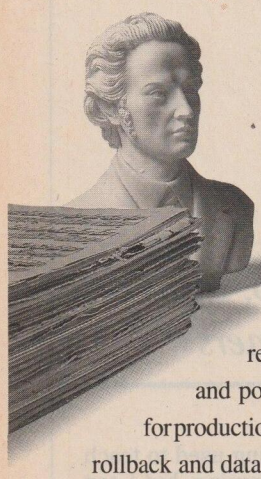

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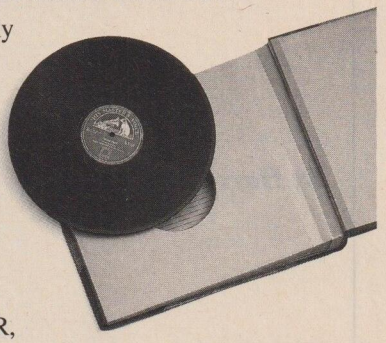

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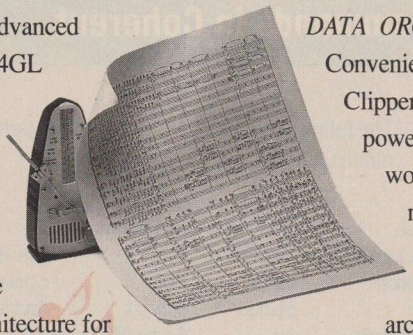

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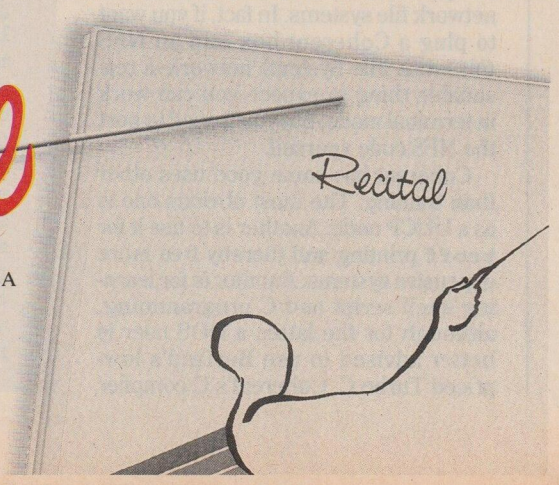

CIRCLE NO. 244 ON INQUIRY CARD

286). Students should be warned that Coherent won't give them full knowledge of all UNIX systems, but they will be able to learn the basics of UNIX. For instance, Coherent's vi clone, **elvis**, is as good as the real thing for introductory vi nightmares.

As for competition, Coherent offers more than the popular MKS Toolkit from Mortice Kern Systems because MKS only provides a UNIX-like shell on top of DOS. It bests Minix from Prentice-Hall for several reasons, but mostly because Mark Williams can draw on its 13-year experience as a compiler vendor and provide effective support. And yes, if you remember back to 1982 and have been wondering, Mark Williams did release a UNIX clone named Coherent then, but it was short-lived.

Very Minimum Requirements

So what do you need to run Coherent? You need an IBM PC AT or compatible 286, 386, or 486 system with at least 7 megabytes of disk space, a smidgin compared to The Santa Cruz Operation (SCO) UNIX or Interactive 386/ix. You can also run Coherent comfortably in 640 kilobytes of system memory (the kernel weighs in at 77 kilobytes), but if you have up to 16 megabytes of memory, Coherent addresses this, too.

For installation, Coherent really plucks a DOS fiddle. The four-diskette package is no more difficult to install than a major DOS application. The install script lets you decide whether to load the **man** pages and dictionary. By omitting these, you save about two megabytes of disk space. Thus, if you're desperate, you can squeeze Coherent onto a 20-megabyte hard disk and still have room for a small DOS partition. The one anomaly is Coherent's **fsck** utility works erratically on partitions of 35 megabytes or more–a limitation not much better than the DOS 3.x limit of 32 megabytes.

At start-up, a dual boot program lets you decide whether to run Coherent or DOS. If DOS is your default partition, you must type Coherent's partition number. This method sounds fine, but I had trouble with it. Coherent booted fine when it had active partition status, but DOS occasionally refused to boot. When I turned the tables and made DOS the active partition, Coherent refused to boot. The imbroglio led me to query Mark Williams, which blamed the BIOS on the test system, a Zeos 386SX. The answer left me scratching my chin because Mark Williams has provided the Zeos.

The incident is typical of other problems Mark Williams faces. The hardest task it has is to make Coherent compatible with system-level devices like disk controllers, video cards, and printers. Coherent includes device drivers for line printers, Hewlett-Packard laser printers, COM1 through COM4, RAM disks, and tape drives, as well as the Adaptec SCSI disk controller, several ESDI controllers, including Ultrascore and Western Digital, and multiport boards from Arnet, Emulex, and SEFCO. A device driver toolkit is also available for $39.95.

I learned about the compatibility question the hard way. After trying to load Coherent onto my standard test system, an ALR Flexcache 386/33, the kernel failed to build. The reason was simple. Coherent doesn't support the ALR's ESDI controller. Give Mark Williams credit, though. It is trying to stay on top of incompatible systems and its release notes list more than 100 compatible systems, memory boards, disk controllers, and BIOS ROMs. The release notes for Version 3.1 list IBM PS/2 MicroChannel models as incompatible systems, and XT, Perstore RLL, and Western Digital WD1004-27X as incompatible disk controllers.

Using Coherent

What can you do with Coherent? Or maybe better phrased, what can't you do with Coherent? For one thing, you can't run X Windows (but Mark Williams says it is working on it). For another, you can't turn a Coherent system into an environment for end users who mostly work with applications.

continued

More UNIX Look-alike Options

When talking about UNIX simulations, one cannot exclude the MKS Toolkit from Mortice Kern Systems (Waterloo, Ont.), or Minix from Prentice-Hall (Englewood Cliffs, N.J.).

I have had the MKS Toolkit on my DOS computer since 1986, and use parts of it daily. The toolkit now offers almost 150 System V- compatible commands, including vi and a Korn shell. On the other hand, the $250 toolkit does not come with a compiler, and **yacc** and **lex** are separate products.

With MKS, you appreciate the fact that it is not necessary to add a different partition to your hard disk. And if you must, the MKS tools can be loaded from a floppy diskette. It is also possible to remap the slash keys to conform to UNIX convention. A fully implemented MKS installation is extremely UNIX-like except for the absence of various utilities. And, of course, because DOS sits underneath the MKS shell, you don't get multitasking or multiuser features.

Minix, which stands for minimum UNIX, more closely resembles Coherent than MKS. Both products are their own operating system and they both simulate AT&T UNIX. Minix, however, is based solely on AT&T's Version 7 of UNIX.

Prentice-Hall supplies complete source code with Minix (a plus compared to Coherent, which does not supply source code). Partially because of the source code, and partially because it has had the field to itself, Minix has developed a loyal following. Many public bulletin boards support Minix forums. Unfortunately, because Prentice-Hall merely distributes Minix, professional support is lacking. If you call the support number, you get an answering machine with a promise to return your call.

One important feature of Minix is it runs on various systems, including 8086 and 8088 systems, the Atari ST, Commodore Amiga, and the Apple Macintosh. In all cases except the Macintosh, Minix runs on the base hardware. On Macs, it runs on top of the native operating system. On a PC, you must set up at least one Minix partition of five megabytes or more, if you are willing to forgo the source code, which adds another five megabytes. For the PC version of Minix, the software is shipped on 12 3-1/2-inch disks.

When it comes to editors, Minix tries to be everything to everyone. Starting with **ed** for the line-oriented, followed by **mined**, a full-screen editor version of **ed**, the choices increase with **elle** for the multifile and multiwindow users, and finally **elvis**, a vi clone for the traditionalist. As for compilers, Minix's 8088 C compiler uses familiar commands, but produces **.s** files rather than **.o** files when the **-c** flag is used. On Macintoshes, the compiler produces **.o** files.

Minix is an evolving operating system, and some commands listed are noted as planned in future releases, including UUCP. But while UUCP is missing, support for networks is present, including remote procedure calls and Ethernet access. In this area, I have to give the nod to Minix. But in most other areas, Coherent represents an advance in UNIX simulation. *—H.A.*

Mark Williams says it's courting vendors to port applications. But as of this review, it had only signed vendors of programmers' products, including /rdb from Robinson Schaffer Wright, Ctree from FairCom Corp., Btree/ISAM from Soft Focus, ash from Free Cloud Software, and CCSH from Comeau Computing. Mark Williams says to expect more vendors when 386 Coherent is ready in mid-1991. This is similar to the prediction that Microsoft has been making for OS/2, meaning you'll have to ask a pundit for an opinion here.

I particularly like the idea of loading Coherent on an old AT and using it as a UUCP node. From a price viewpoint, Coherent is less expensive than RAMnet and UULINK (see UNIXWORLD, March 1989), two popular DOS UUCP packages. The UUCP utilities in Coherent include **uucp**, **uucico**, **uuinstall**, **uulog**, **uuname**, **uutouch**, and **uuxqt**, among others. The documentation also offers an extensive section on UUCP and explains how to make a net connection from the modem up. Mark Williams also promises to walk users through the process as part of its routine telephone support. To test UUCP, I connected my Coherent system to another UUCP system.

A quick look at the table shows a sampling of other utilities available in Coherent. There's the **nroff** text formatter, which old-time UNIX houses might use on old archives. There's **elvis**, written by Steve Kirkendall and modified by Mark Williams. And there's MicroEmacs, public domain software by David G. Conroy and modified by Mark Williams.

If some files in **/bin** look unfamiliar, that's because they are unique to Coherent. Examples are **compress**, **uncompress**, **zcat**, **dos**, and **scat**.

continued

REVIEW HIGHLIGHTS

Coherent
Mark Williams Co.
60 Revere Dr.
Northbrook, IL 60062
708-291-6700

+

Excellent value, easy to install, runs on modest systems, great documentation, worthwhile implementation of UNIX on a PC.

−

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The `compress` utility shrinks files for storage or data transfer, `uncompress` restores them, and `zcat` uncompresses and prints them to the standard output. The `dos` utility lets you list DOS directories, and copy files between Coherent and DOS. The `scat` program prints text files one screenful at a time on the standard output, with options that make it function much like the `pg` utility found on other UNIX systems.

A Coherent Approach

Coherent comes across like a well-planned product, thanks in large part to its documentation. Although a single volume, the Coherent manual blends user guide, reference, and tutorial into a little more than 1,000 pages. It includes long chapters on `sysadm`, `awk`, `bc`, C, make, `ed`, `lex`, macros, stream editor, `elvis`, and MicroEmacs. My one objection is it combines C function calls and system commands and utilities in the same lexicon.

System administration in Coherent is rudimentary. Coherent includes the computer accounting utilities, `ac` and `sa`, and the documentation provides well-written descriptions of password administration, configuring terminals, and file system backups. Users who train on Coherent but later move to a System V will encounter new topics, such as the system administrator's shell and networking, but Coherent provides the basis for learning the fundamentals of system administration.

In case you get too caught up in the excitement of a low-cost UNIX clone, I should stress again that Coherent is best used in an educational setting. Mark Williams itself says it is marketing Coherent to high schools, colleges, and corporate training centers, as well as anyone else who wants to learn UNIX.

For use elsewhere, Coherent suffers from a lack of software. True, enterprising students and home hackers will revel in its C compiler and programming tools, but professional programmers won't leave their Sun and HP workstations for Coherent. To be successful, and I think Coherent will be, it has to woo the very same market that it tested in the early 1980s. Only this time, the market is more sophisticated. And I expect only a pundit would venture whether Coherent will be successful. ■

Editor-at-Large Harry Avant works at the Jet Propulsion Labs in Pasadena, Calif., where he heads a group that investigates tools, techniques, and methodologies related to system-level testing.

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CIRCLE NO. 189 ON INQUIRY CARD

CUSTOMIZING YOUR MODEM COMMUNICATIONS

By Mike Burgard

MLink gives you powerful modem communications, but will you like what you see?

The paradox of interface and function is not unusual to UNIX. In this day of easy-to-use windowing systems, many developers still put *effective operation* before *appearance*. When they sell modem communications software to resellers or directly to DP/MIS shops, as does Corporate Microsystems Inc. (CMI), interface issues are unimportant. The result is often a robust product, like CMI's MLink, but one that looks like an ugly duckling.

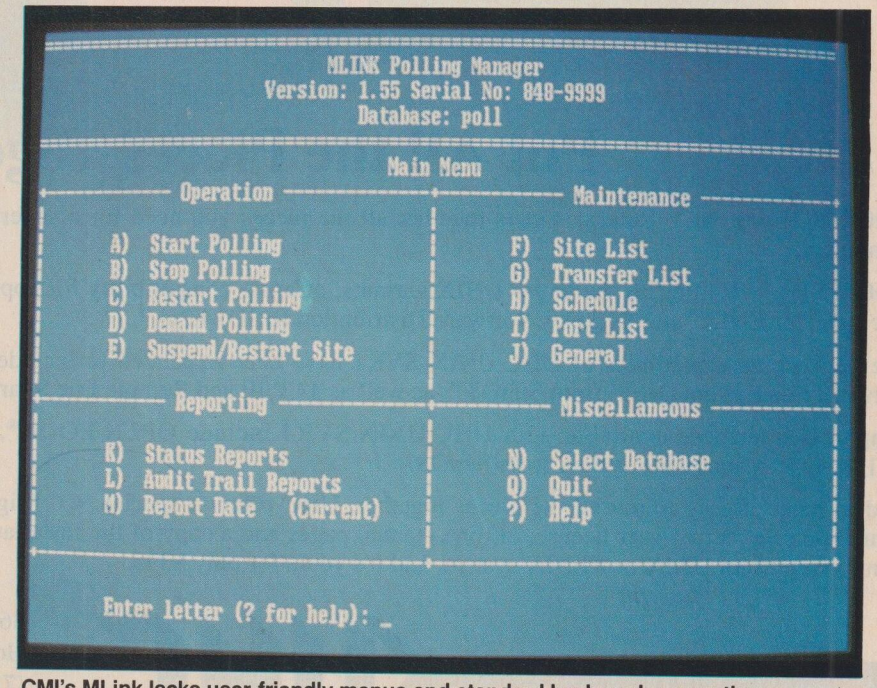
CMI is an old-fashioned UNIX vendor. It knows ever so well that many UNIX users feel comfortable with programming. It is to this plurality of coders–from people writing shell scripts to 4GLs to C, or to someone already writing communications scripts (maybe even in the DOS world)–that MLink has the most appeal. But for users who want ready-made modem communications with user-friendly menus and standard keyboard conventions, MLink is not a beautiful sight.

CMI admits to its lack of aesthetics. It says it prefers to focus new development on performance issues, while postponing interface improvements until UNIX settles on a GUI standard. MLink's compilable scripting language gives you a simple means to create your own interface or build communications routines into other software. The upshot is many MLink end users never see the native interface behind the polished application–an example of which is CMI's Polling Manager, a compiled application for polling remote systems.

MLink is priced well ($295 to $995 for the developer's version) and supports a variety of UNIX platforms. The latest release, version 6.0, runs on 386 systems, AT&T, and DEC systems, with more to follow. Enhancements in the new version occur in the areas of protocols, error checking, scripting, terminal emulation, and interprocess communications (IPC). The new release increases the number of supported protocols by two, but CMI mostly touts MLink's own sliding-frame protocol, which performs at speeds up to 19,200 baud. Transfer times are further reduced through MLink's effective compression routine.

I tested MLink three ways. First, I used it on UNIX and DOS systems to access public networks like MCI Mail. Then I used it on a PC to access an Altos 2000 UNIX System V box, which was also running MLink. Finally, I joined a 386 running SCO XENIX to the Altos 2000 and passed files between all three machines. Installation scripts are provided for every supported system. The installation guide is also one of the best I have seen for a UNIX application.

continued



CMI's MLink lacks user-friendly menus and standard keyboard conventions, but the interface behind the polished application is MLink's plus.

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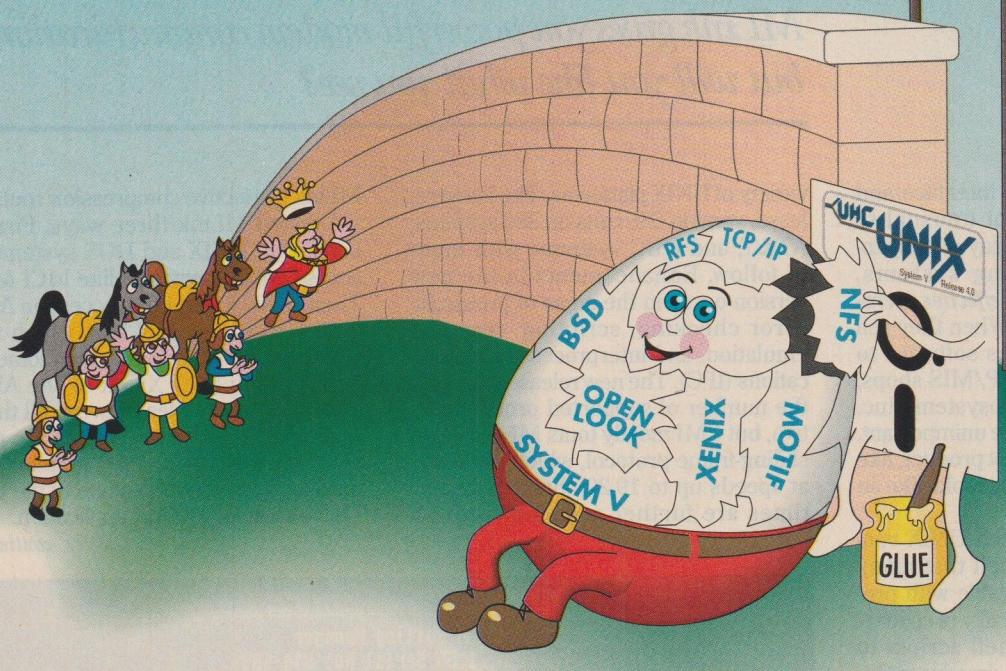

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Interface for the Ages

When you bring up the MLink program, it greets you with a crowded screen of menu options. You select nearly all commands and actions from this full-screen menu. Five of the 12 menu selections lead to other vertical menus. The entire functionality of the MLink developer's toolkit, however, is available in the MLink program.

You won't find friendly pop-up or pull-down menus in MLink, nor quick keys or context-sensitive help. Unfortunately, also absent is extensive protocol support (in either the toolkit or program). Unlike DOS competitors Procomm, CrossTalk IV, and Relay Gold, and unlike UNIX competitor, Term (see UNIX WORLD, October 1989), but like another UNIX competitor, Blast (UNIXWORLD, January 1990), MLink takes a minimalist view of protocols. Supported protocols are Kermit, ASCII, Xmodem, Xmodem/CRC, Xmodem/1K, and its proprietary sliding-frame protocol.

MLink uses either termcap or terminfo when started as a UNIX application. Then, in communications mode, MLink provides several terminal emulations, including DEC/VT series, Televideo, SCO console, Altos, Wyse 50, AT&T 605, and NCR. MLink lets you change keyboard definition files for each emulation to ease cross-emulation problems. Initial setup is also easy. Rather than tying options to a particular phone number or system, MLink saves options such as baud rate, parity, and system-wide settings to disk. Similarly, keyboard definitions are stored in an emulation file, and phone numbers are stored in an auto-dial file.

As for hard-wired communications, MLink only supports RS-232 connections, either directly or through a modem. The total lack of network support makes MLink inappropriate for hooking network PCs to a UNIX host. CMI is working on this shortcoming, but combined with the limited protocol support, bulletin board and network users should look elsewhere.

According to Script

MLink provides a superb scripting environment. The major advantage of MLink's scripting compared to that of Blast and Term is MASS, the built-in MLink compiler. Compiled scripts run faster than interpretive ones and can be called easily from a C front end. You create a script in any ASCII editor and name it with a `.mli` suffix. MASS then creates a formatted listing of the source code (if you specify this option), and creates an object file with a `.mlo` suffix.

The script language itself is a complete one. Beyond the basic communications commands, MLink provides file I/O, flow control, and compiler commands, plus full support for literals and include files. Much of the syntax and form is similar to Basic. Scripts ensure the accuracy and integrity of file transfers, because they perform in a consistent manner (unlike a user at the keyboard). A compiled MLink script also prevents the user from poking around in both the host and remote system.

Because MLink lets you use any ASCII editor, no interactive error reporting occurs while writing a script. After compiling, MASS lists errors by line number and provides error descriptions. MLink simultaneously displays as many errors as will fit on your screen. Error messages are reasonably non-cryptic, but a separate error table, with detailed explanations, would have been helpful. For example, if you misspell a command, MASS points to it, but does not give a hint about the appropriate command. MASS is friendly enough, however.

A debugger accompanies the MASS compiler. The debugger is initialized independently, and then interrupts the script on the first line. You then choose to have the debugger break into the script at selected break points. Each time a break point is reached, the debugger displays all the system or user variables. Unfortunately, the break points cannot be set by line number, label, or variable. Instead, you must use hexadecimal addresses–another example of CMI's resistance to change in key areas.

MLink compiled scripts are machine-independent. This not only makes them portable, but also less expensive. There is no need to purchase a development system for every user. Run-time versions cost about $100 less than competitors Blast and Term.

Interprocess Communications

Interprocess communications is especially interesting to VARs and system integrators. IPC is MLink's way of orchestrating input and output. It uses UNIX's "named pipes" facility to pass output from one application to another application. As an intermediary in this scheme, MLink gets a chance to filter and modify data before sending it to one or more applications, per script, of course.

Frequently, IPC acts as a queue for MLink. Say you have a point-of-sale (POS) terminal on a UNIX system. IPC is an ideal tool to assist with credit card authorization: transaction information such as dollar amount, card number, and expiration date are passed by the POS application to the IPC queue, where the data waits until MLink finishes processing any prior authorizations. Next, the new data is given to MLink without redialing the same host. Even with IPC, however, MLink is a single session product as opposed to multiple session 3270 emulation products running under UNIX.

MLink uses the industry-standard CRC-16 error checking in its proprietary sliding-frame protocol. The sliding frame consists of a certain number of bytes per block (usually 256) and multiple blocks per frame (usually 8, but it can vary, hence the term "sliding frame"). MLink sends these block groups together. If an error occurs, only

REVIEW HIGHLIGHTS

MLink
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Robust scripting language with interprocess communications support, fast and reliable file transfer, good terminal emulation, relatively inexpensive.

Poor user interface, lack of quick keys or menu shortcuts, limited number of protocols, limited compiler error reporting.

Version: *6.0.*
Systems: *SCO XENIX/SCO UNIX, Interactive 386/ix, Altos, Arix, AT&T 3B2, Data General Aviion, DEC/Ultrix, HP 9000, IBM AIX, Motorola, Macintosh, NCR Tower, NCR 3000, Pyramid, Sequent, Sun, Unisys. MLink also runs under DOS, Concurrent DOS, Theos, and OS/2.*
Licensing: *Per user.*
Price: *for run-time version, $185 to $775; for developer's version, $250 to $995.*
Support: *8:00 a.m. to 5:30 p.m. (EST). Toll-free support available to customers on extended maintenance.*
Warranty: *Unconditional.*

the data from the error to the end of the frame is re-transmitted, meaning reduced transmission times for the end user. Overall, this system is efficient, but still falls short of Blast's capability to send and receive simultaneously.

LZW compression helps MLink achieve high speeds. In informal transmission benchmarks, I measured effective communication rates at slightly under twice the line speed. For example, transferring a data file at 2400 baud resulted in a transmission speed of nearly 422 characters per second. Without compression, I only managed speeds of 210 characters per second.

File Transfers

The preferred way to use MLink is by connecting a host and remote system, with each running its own copy of MLink. You would also likely use MLink's proprietary protocol, plus data compression, in order to maximize the speed of transfers.

One way you can execute an MLink command-line transfer is by entering `Topc /usr/bin/trash.dat = c:\excel\trash.dat` on the UNIX host. This invokes the transfer routine without the MLink menus, and moves the file from the host machine to your machine. In general, the sliding-frame protocol is quick and accurate, but it does not report on transfer time or required disk space for a file. The latter can result in a disk full error when downloading a large file.

If need be, you can run MLink in the background and let the communications session continue while you work on another activity. In DOS, MLink can run as a memory-resident application in order to simulate background operation. In UNIX, not only does MLink run in the background, the IPC code can run in the background as a traffic cop, responsible for managing the MLink queue and dealing with multiple inputs.

MLink is a solid product with a loyal following of users. It is poorly designed for mass-market users, but a good fit for professional scripting situations such as polling, software updating, and data downloading. In these areas, MLink often equals or surpasses its competition. The old "know thyself" adage applies: if you can write scripts and live with a limited selection of protocols, MLink is for you. ■

Michael Burgard is a regular reviewer for UNIXWORLD and a data systems information manager for a commercial printing company in Montana.

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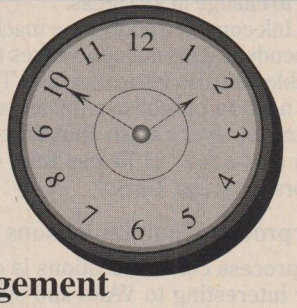

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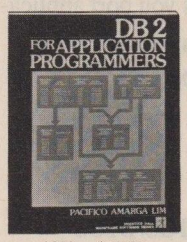

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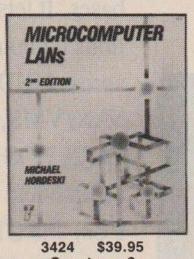

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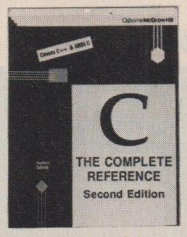

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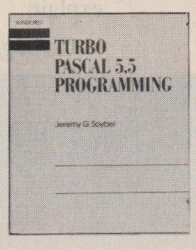

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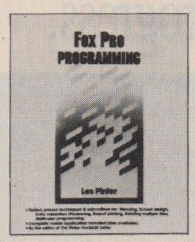

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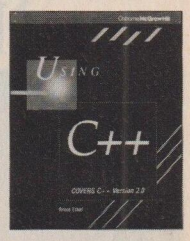

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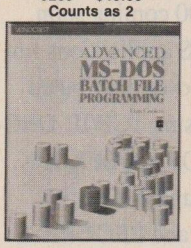

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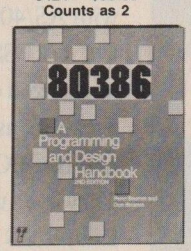

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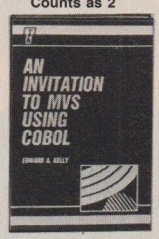

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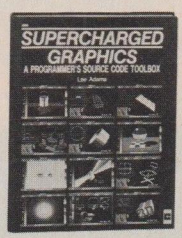

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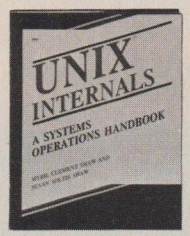

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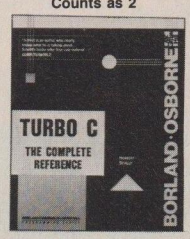

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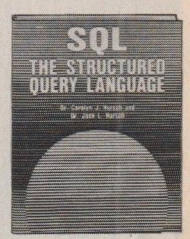

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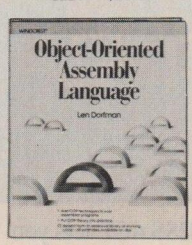

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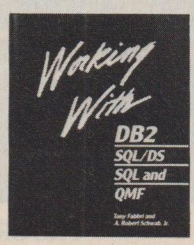

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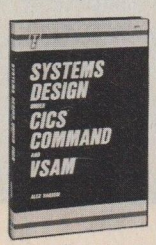

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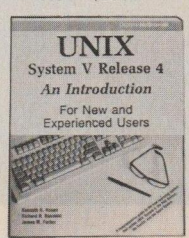

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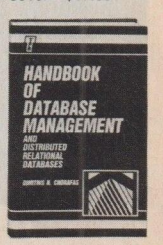

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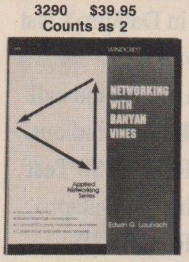

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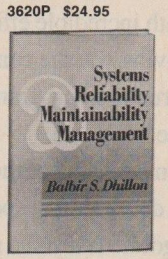

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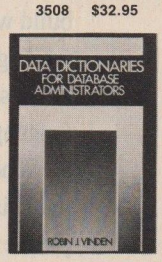

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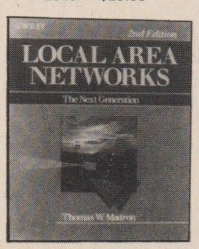

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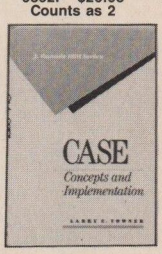

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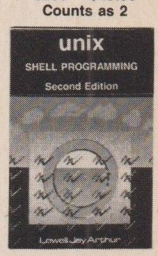

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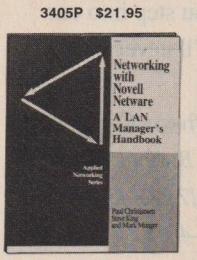

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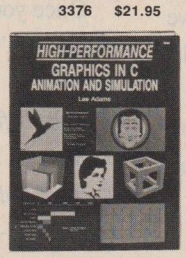

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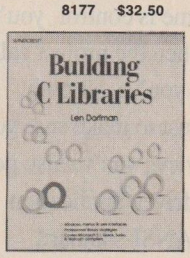

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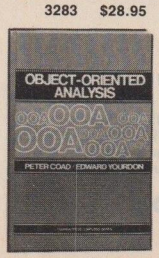

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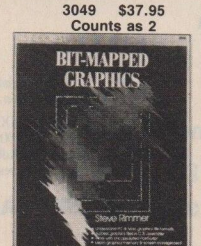

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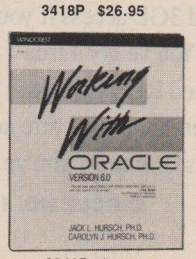

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Update by Frank Hayes

CLOUDS OVER COMPRESS, CLEAR SKIES FOR SQL AND NETWORKING

What happens when a computer company has a patent on part of a proposed standard? That question has recently stirred up concern over a part of the evolving Posix standard for UNIX-like open systems. The standard is Posix's User Portability Extension, which defines a set of utilities commonly used with UNIX systems. The patent is on the data-compression technique used in **compress**, one of those utilities.

Some groups–including the Cambridge, Mass.-based League for Programming Freedom–say the question highlights the need to abolish software patents entirely. But it may turn out to be a non-issue if the patent's owner is willing to license the technology.

compress, the software at the center of the storm, is a widely used utility for reducing the size of files before sending them over a network. Using **compress** can reduce text files to half their original size or less, which significantly reduces network traffic. Once the file is received, it's typically returned to usable form with either the **uncompress** or **zcat** utilities, although the compressed versions of some files are also used for archiving.

Because **compress** is so widely used, the IEEE committee drafting the Posix User Portability Extension (IEEE 1003.2) is considering naming **compress** as part of the standard. But there's a catch: Data compression in **compress** is based on a routine known as the LZW (or "Lempel-Ziv-Welch") algorithm–and Unisys has a patent on it. Until everyone's sure they know what that means, there's a cloud over **compress**.

How did it happen? Ironically, because Unisys wanted people to know about LZW. In the mid-1970s, a pair of researchers–Abraham Lempel at the Sperry Rand Research Center in Sudbury, Mass., and Jacob Ziv at Bell Labs–developed both a theory and a new technique for data compression. A paper on their approach, which became known as "Lempel-Ziv compression," was published in the journal *IEEE Transactions on Information Theory* in May 1977. But implementations of Lempel-Ziv compression were complex and memory-hungry.

However, in the June 1984 issue of *IEEE Computer*, another Sperry researcher, Terry A. Welch, described a simplified implementation called LZW (for Lempel-Ziv-Welch). LZW was simple and fast, and worked well without huge amounts of memory. In fact, it was simple enough that Welch described how to program the algorithm in detail, with examples, in his article.

No one knows for sure whether LZW licensing is in the cards for operating system vendors

Welch's article stated that both hardware and software implementations of LZW were proprietary to Sperry (a patent application for the algorithm had been filed in mid-1983). Despite this, LZW became widely adopted as a data compression scheme, and the most popular UNIX implementation, **compress**, became a de facto standard. Meanwhile, Sperry received its patent in 1985, and Unisys (which was formed when Sperry merged with Honeywell) inherited the rights.

Faced with the prospect of standardizing a patented technology, the 1003.2 committee has several possible alternatives. They could choose a different file compression algorithm. But many UNIX systems use **compress** for archived files; switching to something else would immediately make all currently compressed files inaccessible. A second option is substituting another Lempel-Ziv compression system that doesn't use the LZW algorithm, but would still be able to uncompress existing archives that were created using LZW-based **compress**. That may be technically feasible, but it requires creating a new, previously untested algorithm. Yet another possibility is a legal challenge to Unisys' patent–but that's not something a Posix committee is likely to do.

The fourth possibility is actually using **compress**, and expecting Posix-compliant system vendors to license the appropriate rights from Unisys. That's not uncommon–several familiar standards, such as Ethernet, use proprietary technology.

Will Unisys allow LZW to be broadly licensed for **compress**? The company didn't have an official answer at deadline time. But Unisys is already licensing LZW for a different international standard: CCITT's (International Telegraph and Telephone Consultative Committee) V.42bis, a data communications standard for high-speed modems. In late 1989, Unisys announced it would license LZW to any modem manufacturer for a one-time fee of $20,000.

So is the **compress** question a tempest in a teapot? Will Unisys license LZW to operating-system vendors in the same way it does for modem vendors? That's a reasonable conclusion–but for the moment neither Unisys nor the Posix committees seem to know for sure.

SQL Access Moves Forward

While official standards organizations struggle with patent problems, an almost endless array of industry consortia and working groups have their own problems. Some try to develop their own standards to submit to official standards committees. Others take the results of those committees and try to tie off the loose ends that make the difference between an official standard and products that will work together.

One painfully familiar example is Structured Query Language, or SQL. In simple terms, SQL is a language for accessing databases. IBM created it, and it's become increasingly popular for relational database management systems

(RDBMSs). SQL became so popular, in fact, that ANSI (the American National Standards Institute) granted a version of SQL formal status as an ANSI standard.

Unfortunately, by the time ANSI officially published its standard, there were already many incompatible versions of SQL available. For example, IBM's own SQL, used in the company's DB2 mainframe database system, isn't ANSI-compliant. And IBM isn't alone; because of options and unspecified elements in ANSI SQL, it sometimes appears that no two versions of SQL work exactly alike. Error messages aren't the same, for example, and catalogs and dictionaries may react differently to the same SQL command under different systems. As a result, applications that query an RDBMS using SQL have to be written specifically for a particular vendor's RDBMS and version of SQL–hardly a good application of a standard.

To deal with the compatibility problem, a group of RDBMS vendors came together more than a year ago to form the SQL Access Group. SQL Access wanted to standardize the SQL standard by defining an applications programming interface (API) for SQL and C, so that SQL calls would always produce consistent results. The group included most major RDBMS vendors, with only two significant exceptions: IBM and Sybase.

IBM was no surprise–with its huge installed base and 800-pound gorilla reputation, IBM was unlikely to support any group that might change the standard that its proprietary customers use.

But as a major database software vendor, Sybase was more of a problem for SQL Access. Most SQL Access vendors have products that work by sending straightforward SQL commands to a database. Sybase's SQL Server, by contrast, is designed for sending entire subroutines to the server; the subroutines can then be invoked with a command that's embedded in an SQL query. That is, Sybase was arguing for an extensible version of SQL that went well beyond the ANSI standard. Without Sybase, could a collection of fiercely competing vendors hold their coalition together?

Apparently so. SQL Access has completed its initial draft of the new, more-standard-than-the-standard specification for SQL. The new draft, which closes most of the loopholes in the ANSI standard, has been in SQL Access members' hands for several months. The group expects to be able to demonstrate the technology by mid-1991. If it works, it could turn ANSI's theoretical standard into practical products that can actually be mixed and matched by vendors and system integrators.

And holdout Sybase is no longer a holdout. Now that the interface for embedded SQL queries is complete, SQL Access is moving on to the call-level interface. That's the area with which Sybase is most concerned, so it's no surprise the company has signed up, as have other vendors such as Microsoft. That leaves only IBM as a major nonmember–and SQL Access members aren't holding their breath waiting for Big Blue.

The Truce May Be Harder Than the War

Another standards war may have finally come to a truce. Partisans of SNMP (TCP/IP's Simple Network Management Protocol) and CMIP (Open System Interconnection's Common Management Information Protocol) stood up at the recent Interop 90 exhibition and agreed that each of the two protocols has its uses in managing networks.

Jeff Case of SNMP Research represented the SNMP side; David Maher of Hewlett-Packard represented the CMIP forces. Both Case and Maher agreed that there was room for both protocols, and that each had particular strengths. SNMP, they said, is the protocol of choice for network managers to communicate with network elements, such as bridges, routers, and gateways. CMIP, by contrast, is the protocol of choice among managers in the hierarchies necessary to keep track of large-scale networks.

No standards committee could convince diehard TCP/IP users of CMIP's and OSI's advantages

If this sounds like a boring announcement, it was intended to be: Case and Maher were heading off a new set of battles between SNMP and CMIP extremists. Those fights have verged on religious warfare since the introduction of CMIP.

SNMP is widely used on TCP/IP networks, and TCP/IP is the standard protocol for linking UNIX machines. CMIP, by contrast, is the network management protocol for OSI, which has long been touted as the future replacement for TCP/IP.

OSI is the heir apparent to TCP/IP's throne–OSI is an international standard, and it's specifically designed to solve problems associated with large, diverse networks of networks. But OSI has been slow in maturing, and it's been making its way in the face of a large installed base for TCP/IP.

There are technical issues holding back OSI as well. OSI defines seven levels at which various elements of networks operate. CMIP spans all seven layers; SNMP fits into the scheme at the fourth, or transport, layer. SNMP, true to its name, is relatively simple, so it's more useful for small systems (such as DOS-based PCs) that might be connected to TCP/IP networks. CMIP, by contrast, is too large in its full implementation to fit into those smaller machines, although UNIX systems can generally handle it without difficulty.

Meanwhile, all the standards committees in the world weren't about to convince diehard TCP/IP users that CMIP and OSI were a better way to go. That was especially true after the introduction of CMOT (for "CMIP Over TCP/IP"). CMOT was intended as a bridge approach that would let TCP/IP users ease their way into CMIP. Instead, open warfare broke out between SNMP and CMIP partisans–sniping that lasted until late 1989.

Peace was short-lived. Last summer, IBM and 3Com introduced a new, scaled-down version of CMIP and issued a white paper about the relationship between CMIP and SNMP–at the same time as the IEEE was meeting to discuss a new implementation of SNMP. The IBM/3Com version of CMIP would operate on the second, or MAC, layer of the OSI stack–the same layer as the proposed new version of SNMP. It was head-to-head competition again–and new warfare seemed inevitable, until Case and Maher stood up to agree that all was forgiven.

The Interop 90 announcement seems to have cooled things down again–at least in some quarters. But Jeff Case says that at least some SNMP partisans still don't believe he really meant what he said at Interop. "There are some people who will tell you I looked like a prisoner of war up there," Case jokes. "That I was sending secret messages with my eyes–'I don't believe any of the things I'm saying, but say hello to my wife.' Some people were quite disappointed–they were looking for a cat fight."

It may be a long, hard truce. ■

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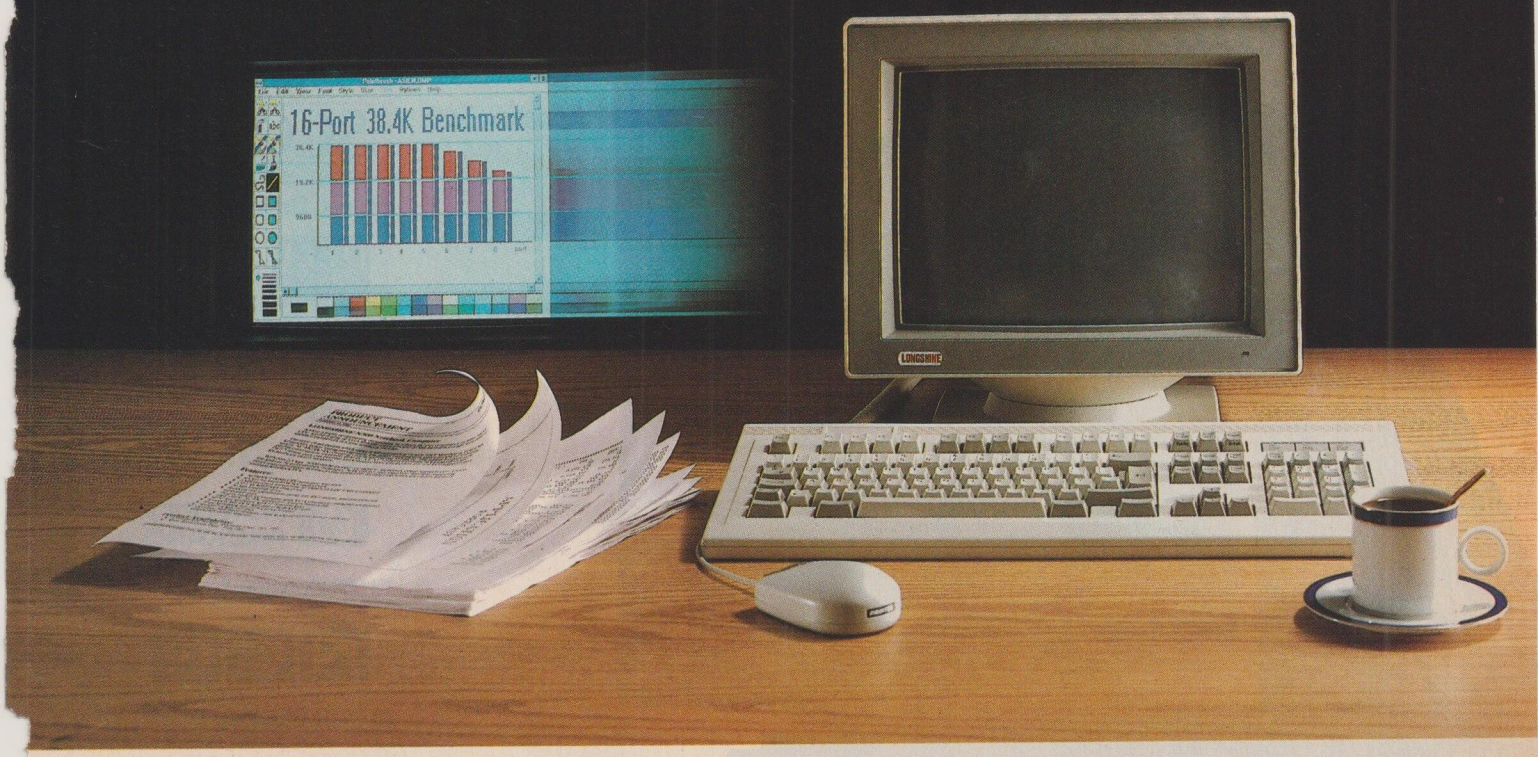

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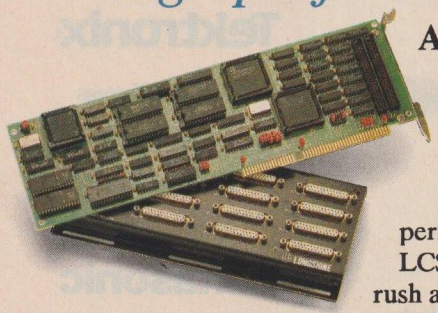

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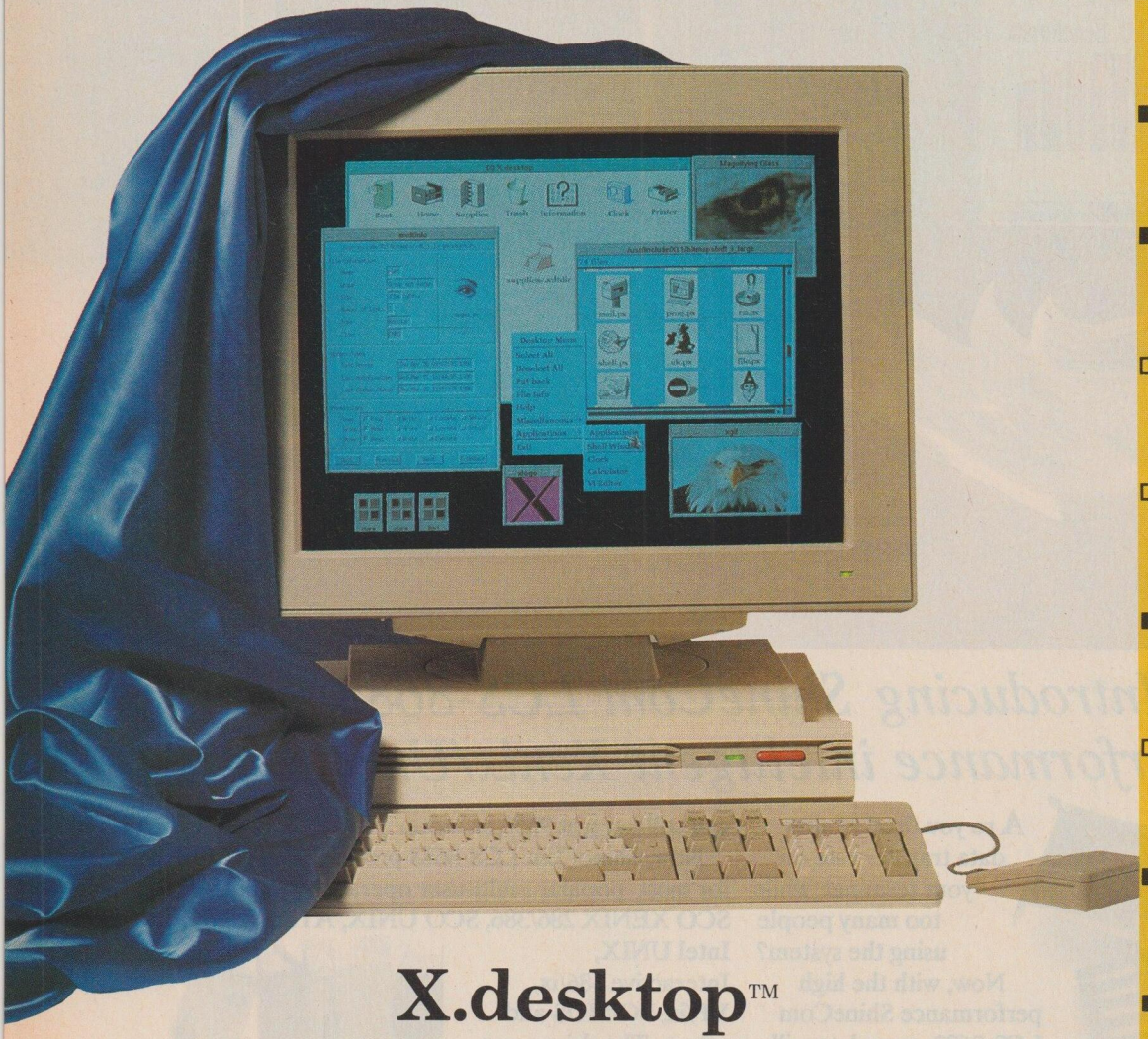

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USER-DEFINED C++ DATA TYPES

Part II of this tutorial series continues the exploration of C++ with user-defined data types and operator overloading

by Gail and Paul Anderson

Paul Anderson is president of Anderson Software, a UNIX training company specializing in courses on UNIX, C, and C++. Gail Anderson, co-founder of Anderson Software, designs and writes software in C++. They co-authored two textbooks: *The UNIX C Shell Field Guide* and *Advanced C: Tips and Techniques*. This article is copyright 1990 by Gail and Paul Anderson in Leucadia, Calif.

Last month we introduced C++ by exploring the concept of data encapsulation. We showed you how to group functions and data together in a class declaration, hide the implementation details, and make an object's operations accessible to a user program. With this approach you can control the life cycle of an object: its creation, its legal operations, and its destruction.

As an example, we wrote a program that filled an integer array with numbers entered from the keyboard, sorted, and then displayed the numbers. We hid the implementation of the array (the private data and functions) and made the operations accessible as public functions (filling, sorting, and printing). We also touched on some general language improvements that C++ offers over Kernighan and Ritchie C, including a new comment style, function prototypes and default parameters, reference variables, free store operators, `inline` and `const` qualifiers, and input and output stream operators.

This month, we extend the idea of defining and controlling an object by introducing user-defined data types. Specifically, we'll create a new type much like the built-in types we use in our C or C++ programs. Our new data type should have the same operations that exist for built-in types, such as assignment, creation, initialization, copying, and destruction. We may also want to redefine one or more of the arithmetic or comparison operators. Exactly which operations we choose are design issues that are subject to the requirements of the users. However, there are certain rules we must follow and guidelines to consider. Think of them as a cookbook for creating user-defined types.

Our example of a user-defined data type will be an integer with built-in range checking. That is, every time this new integer object takes on a value, we verify that the value is within a specified minimum and maximum. When we declare a range-checking integer object we'll specify minimum and maximum values that can't change. Our special integer type is useful as a debugging aid in programs where an integer's known range is a subset of the standard integer's range (we do not detect overflow or underflow conditions). There is also a default range and initial value for these new integer objects. We'll call this special integer data type `Int` to distinguish it from the standard C++ integer `int`.

Determining User Requirements

When you design a new data type, take off your programmer hat and become a language designer. To do so, consider such questions as: What operations should I provide? What do the C++ default operations do? What built-in conversions do I want to define? How will my new data type be used? These questions are best answered by looking at code that a user of your new data type might write. So, first we'll look at Listing 1A, which uses data type `Int`. The output of this program appears in Listing 1B.

Declarations and Initializations. In Listing 1A, line 3 includes the header file `Int.h`, which contains the class declaration for `Int`. This file must be included in any module that declares an `Int` object. (We'll look at the file contents later.) Line 13 declares `Int i` with a range of -1,000 to 1,000 and an initial value of 100. That is, the value of `i` cannot exceed 1,000 or fall below -1,000 without causing a run-

time error. The first argument of the declaration sets the initial "value," the second argument specifies the minimum, and the third sets the maximum. Similarly, Listing 1A, line 14 declares `Int j` with an initial value of 5 and a legal range between zero and 1,000. `Int k` (line 15) starts out at 10 and makes the minimum zero. But what about the maximum? Here, it is set to a predefined default. Line 16 declares three `Int` variables, and because there are no arguments, these also must take on default values.

Line 19 declares variable `aa` with an initial value of 500. This is a more familiar form of initializing a variable with a single value; this form is equivalent to `Int aa(500)`. The "equals sign" (=) notation is attractive because it matches the initialization syntax for built-in types, such as `int i = 5`. Although lines 19 and 20 each contain an equals sign, they are initializations and not assignments. (Assignments can only occur with variables that already exist.) Both lines 20 and 21 initialize `Int` objects with `Int a`, also an `Int` object. Line 22 declares an array of `Int` objects with `MAXNUM` elements, line 23 declares an integer initialized by `Int y`, and lines 27 and 28 illustrate input and output operations.

The rest of Listing 1A shows various operations, including assignment (lines 36 and 38), update (line 37), increment and decrement (lines 39 and 40), and binary arithmetic (lines 41-43). Lines 52-55 contain a "for" loop using `Int` variable `index` as the control variable. This construct illustrates initialization, the comparison operator <, the increment operator ++, assignment, and output. Note that many of these statements mix `Int` and `int` operands. Lines 45 and 46 are test cases that you should keep in mind when writing any assignment function. Chained assignment (line 45) allows multiple assignments in a single statement. Self-assignment (line 46) allows an object to take on the value of itself. (Some classes will have order dependencies for self-assignment to work correctly.)

Remember that any operation that changes the value of an `Int` must check the new value against its range. Thus, assignment (=) and variations of assignment, such as update (+=) and increment (++), must perform range checking. Our test program terminates while executing the last statement (line 56) because the increment operation makes variable `index` exceed the allowed maximum.

continued

LISTING 1: Program `main` illustrates the use of a user-defined data type `Int`, an integer type with built-in range checking.

A. Listing of the `main` program source code:

```
 1  // main.C : program that uses data type Int
 2
 3  #include "Int.h"
 4  #define MAXNUM 5
 5
 6  main ()
 7  {
 8     // Declarations:
 9
10     // the default minimum is INT_MIN, default maximum is INT_MAX
11     // both defined in <limits.h> standard header file
12
13     Int i(100,-1000,1000);  // -1000 <= i <= 1000        i = 100
14     Int j(5,0,1000);        // 0 <= j <= 1000            j = 5
15     Int k(10,0);            // 0 <= k <= INT_MAX         k = 10
16     Int a, b, c;            // INT_MIN <= a <= INT_MAX   a = 0
17                             // same for b and c
18
19     Int aa = 500;           // INT_MIN <= aa <= INT_MAX
20     Int y = a;              // create y from a
21     Int d(a);               // create d from a; equivalent syntax
22     Int Intarray[MAXNUM];   // array of MAXNUM Int's; uses defaults
23     int myint = y;          // Int to int conversion,
24                             // int initialization
25     // Input/Output:
26     cout << "Input an Int: ";
27     cin >> k;                        // input
28     cout << "k=" << k << '\n';       // output
29
30     // Operations:
31
32     if (a == b) cout << "The same.\n";              // comparison
33     a++;
34     if (a > b) cout << "a > b\n";                   // comparison
35
36     i = 5;              // assignment int to Int
37     j += i;             // update +
38     j = k;              // assignment
39     j++;                // auto-increment
40     k--;                // auto-decrement
41     j = i + k;          // binary + arithmetic operator, assignment
42     j = i * k;          // binary * arithmetic operator, assignment
43     j = i + 5;          // binary + with int, assignment
44
45     k = i = j;          // chained assignment
46     i = i;              // self-assignment
47     cout << "i=" << i << '\n';  // output
48     cout << "j=" << j << '\n';  // output
49     cout << "k=" << k << '\n';  // output
50
51     // initialization, comparison, increment
52     for (Int index(0,0,MAXNUM); index < MAXNUM; index++) {
53        Intarray[index] = index;                    // assignment
54        cout << Intarray[index] << '\n';            // output
55     }
56     index++;                                  // out of range error
57  }
```

B. Sample run of program `main` with output (on our 32-bit machine):

```
$ main
Input an Int: 99
k=(99, 0, 2147483647)
The same.
a > b
i=(10, -1000, 1000)
j=(10, 0, 1000)
k=(10, 0, 2147483647)
(0, -2147483648, 2147483647)
(1, -2147483648, 2147483647)
(2, -2147483648, 2147483647)
(3, -2147483648, 2147483647)
(4, -2147483648, 2147483647)
Integer out of range (value=6,min=0,max=5).
$ □
```

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Program Output. Listing 1B shows the output obtained when you run the program compiled from `main.C`. Of interest are the lines surrounded by parentheses, which show the default minimum and maximum values for an `Int` object. These values are the predefined values `INT_MIN` and `INT_MAX` found in the standard header file `/usr/include/limits.h`. The values displayed are machine-dependent (here they represent the minimum and maximum integer values on our 32-bit machine).

The Class Declaration

Now that you've seen how to use the `Int` data type, it's time to design the class. Let's start with the file `Int.h` (shown in Listing 2A), which contains the `Int` class declaration.

File Organization. In our example, the file `main.C` (Listing 1A) contains the client code that uses data type `Int`. File `Int.h` (Listing 2A) contains the class declaration and any inline function definitions. File `Int.C` contains the class function definitions, the code that implements the class (Listing 2B). Lines 1 and 2 in file `Int.h` use the preprocessor to conditionally compile the contents of this file, which allows us to include this header file in other files without worrying about including the class declaration more than once.

Private Section. The class `Int` private section (Listing 2A, lines 11-15) contains an integer to hold the value, `int value`, and two constant integers for the minimum and maximum range values, `const int min` and `const int max`. Because they're designated `const`, the compiler prevents you from modifying `min` and `max` once the constructor initializes them. You will see that defining a class with one or more constant data items requires some special handling with assignment and initialization functions. We'll point out the special handling as it comes up in the implementation code. Private function `badInt()` performs the run-time error handling when an out-of-range condition occurs. The function is private because only class `Int` member functions call it.

The public section defines how to access `Int` objects. Let's look at the constructors first.

Constructors. The first constructor (Listing 2A, line 18) is called a "void constructor," because its argument list is void. Whenever you declare an `Int` object without initialization arguments (as in Listing 1A, line 16), the compiler invokes the void constructor. Furthermore, because C++ doesn't provide a way to pass initialization arguments to a constructor when declaring an array of class objects, you should provide a void constructor to allow array declarations of class types (as in Listing 1A, line 22). Without arguments, the constructor must somehow provide default initialization values. Following the colon (:) in Listing 2A, line 18 is a "member initialization list," which is a list of data members with their initialization values in parentheses. Why is this list necessary? Recall that data members `min` and `max` are `const`. Once we enter the body of the constructor, these data members exist, making any statement that attempts to give them values an illegal assignment to a constant. The member initialization list is the only way to initialize a constant data member (the special handling of constants required during initialization). The body of the void constructor initializes `value` to zero.

Listing 2A, line 19 declares the prototype for the second constructor, a function taking one, two, or three integer arguments. The minimum and maximum range values are specified

LISTING 2: The implementation of user-defined data type `Int` uses two files—one contains the class declaration and the other defines all the member routines not already defined in the declaration file.

A. File `Int.h` contains the `Int` class declaration. Users of type `Int` must include this file in their programs:

```
 1  #ifndef INTH
 2  #define INTH
 3
 4  // Int.h - class Int: integers with range checking operations
 5
 6  #include <stream.h>
 7  #include <limits.h>
 8  #include <stdlib.h>
 9
10  class Int {
11  // Private Section
12     int value;
13     const int min;
14     const int max;
15     void badInt(int);
16  public:
17  // Constructors
18     Int(void): min(INT_MIN), max(INT_MAX) { value = 0; }
19     Int(int v, int minval = INT_MIN, int maxval = INT_MAX);
20
21  // Assignment, Update Operators
22     Int & operator=(const Int &);
23     Int & operator+=(const Int &);
24     Int & operator-=(const Int &);
25     Int & operator/=(const Int &);
26     Int & operator*=(const Int &);
27
28  // Increment, Decrement Operators
29     Int operator++();     // postfix ++
30     Int operator--();     // postfix --
31
32  // Cast Operator
33     operator int () { return value; }
34
35  // I/O Operators
36     friend ostream & operator<< (ostream &, const Int &);
37  };
38     istream & operator>> (istream &, Int &);
39  #endif
```

B. File `Int.C` implements the range-checking integer type, `Int`:

```
 1  // Int.C - class Int: integers with range checking operations
 2  #include "Int.h"
 3
 4  Int::Int(int v, int minval, int maxval) : min(minval), max(maxval)
 5  {
 6     if (v < min || v > max)
 7        badInt(v);
 8     value = v;
 9  }
10
```

continued

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as default arguments. If not provided, the compiler uses `INT_MIN` for the minimum and `INT_MAX` for the maximum. The compiler invokes this constructor any time you specify integer initialization values in a declaration, as in lines 13-15 and 19 in Listing 1A. The body of this constructor is in the implementation file, `Int.C`.

Constructors as Conversion Functions. Because our constructor declared in Listing 2A, line 19 allows a single integer as its argument, we now have a way to perform integer to `Int` conversion, which is important for several reasons. First of all, the expression `Int(j)`, where `j` is an integer, is actually a cast that converts `j` into an `Int` using this constructor. Second, when you pass an integer to a function whose prototype specifies an `Int`, the compiler now invokes this constructor to convert the `int` into an `Int`. This conversion constructor is exactly what we need to use integers in expressions with `Int` objects (such as Listing 1A, line 36).

Operator Functions. The remaining declarations in `Int.h` are operator functions, prototypes of functions that enable us to "overload" (give new meanings to) the predefined C++ operators for `Int` variables. Overloading is not a new concept; in fact, you're already familiar with built-in operator overloading in C++. For example, when you declare two integers `i` and `j` and specify an expression of the form `i + j`, the compiler performs integer addition. And, for floats `f` and `g`, and the expression `f + g`, the compiler performs an addition operation for floating-point variables. Thus, the

Listing 2 continued

```
11  // assignment operator:
12  Int & Int::operator=(const Int & i1)
13  {
14     if (i1.value < min || i1.value > max)
15        badInt(i1.value);
16     value = i1.value;
17     return *this;
18  }
19
20  Int & Int::operator+=(const Int & i1)
21  {
22     *this = value + i1.value;
23     return *this;
24  }
25
26  Int & Int::operator-=(const Int & i1)
27  {
28     *this = value - i1.value;
29     return *this;
30  }
31
```

continued

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built-in binary addition operator + has different meanings depending on the data type of its operands.

To overload an operator in C++, provide a function prototype that contains a return type, the keyword `operator`, the operator symbol (such as + or ==), and an argument list, using the syntax: *return-type* `operator` *operator-symbol* (*argument-list*). For example, Listing 2A, line 22 declares a function that overloads operator =. This function returns a reference to an `Int` and takes `const Int &` as its argument. When you code an assignment of the form `i = j`, where `i` and `j` are `Int`s, the compiler invokes the function `i.operator=(j)`. Similarly, the statement `i += j` invokes the function `i.operator+=(j)`. In both cases, the left-hand operand is the object that invokes the member function and the right-hand operand becomes the function argument. All of the assignment and update operators follow this pattern, as shown in Listing 2A, lines 22-26.

Lines 29 and 30 are the prototypes for the increment and decrement operators, ++ and --, respectively. These functions do not take any arguments and return an `Int` value. The expression `i++` invokes the function `i.operator++()` if `i` is declared `Int`. Similarly, the expression `i--` invokes the function `i.operator--()`. (Many current versions of C++ do not distinguish between expressions with an overloaded postfix increment operator such as `i++`, and one with a prefix increment expression, such as `++i`. C++ is, however, undergoing a revision to allow users to supply both a postfix and prefix version of increment and decrement functions. The

Listing 2 continued

```
32  Int & Int::operator/=(const Int & i1)
33  {
34     *this = value / i1.value;
35     return *this;
36  }
37
38  Int & Int::operator*=(const Int & i1)
39  {
40     *this = value * i1.value;
41     return *this;
42  }
43
44  // postfix ++  evaluate then increment
45  Int Int::operator++()
46  {
47     Int temp = *this;     // copy initializer
48     *this += 1;
49     return temp;
50  }
51
```

continued

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Listing 2 continued

```
52  // postfix --  evaluate then decrement
53  Int Int::operator--()
54  {
55     Int temp = *this;     // copy initializer
56     *this -= 1;
57     return temp;
58  }
59
60  istream & operator>> (istream & is, Int & i1)
61  {
62     int temp;
63     is >> temp;
64     i1 = temp;            // Int assignment with range checking
65     return is;
66  }
67
68  ostream & operator<< (ostream & os, const Int & i1)
69  {
70     os << '(' << i1.value << ", " << i1.min << ", "
71        << i1.max << ')';
72     return os;
73  }
74
75  void Int::badInt(int v)
76  {
77     cerr << "Integer out of range (value=" << v << ",min="
78          << min << ",max=" << max << ").\n";
79     exit(-1);
80  }
```

technique is discussed on pages 338-9 of the book, *The Annotated C++ Reference Manual*, by M. Ellis and B. Stroustrup, published by Addison-Wesley, 1990.

Cast Operator. Line 33 declares an operator function that converts an `Int` into an integer. This is the "cast operator," so called because it allows you to cast an `Int`, producing an `int`. While the conversion constructor declared in line 19 converts an integer to an `Int`, this function provides the opposite conversion, `Int` to integer. Together, we now have a two-way conversion defined between integers and `Int`s. For example, the expression `int (j)`, where `j` is declared `Int`, evaluates to an integer. The form of the cast operator is a member function `operator` *type* `()`, where *type* is the type to which you are converting. The type you are converting from is the owning class of the member function. Note that you do not supply a return type and there are no arguments. Also, *type* may be a built-in type (as in our example) or a user-defined type (another class). The cast operator function in Listing 2A, line 33 is an inline function that simply returns data member `value`.

Although our user program is sprinkled with examples using the binary arithmetic operators (such as + and *) and comparison operators (such as < and ==), you'll note that our class declaration does not define these operators at all. How is this possible? The answer is that by providing the above cast operator function for `Int` to integer, we are specifying that `Int` operands be converted to integers for integer operations. Therefore, when you code `j = i + k` (see line 41 of Listing 1A), `i` and `k` convert to integers that are the operands for the integer addition. The result is also an integer. The compiler then invokes the conversion constructor (line 19 of Listing 2A) to convert the integer result back to an `Int`, required by the prototype of the assignment operator. The two-way conversion path is important, because it allows you to use the special range-limited integers as regular, built-in integers.

Stream I/O Overloading. The last two functions (lines 36 and 38 in Listing 2A) overload the stream output operator << and input operator >>. The output operator prototype introduces a new C++ keyword, `friend`. Friend functions are not member functions (even though they are declared within the class), but they carry the privilege shared by member functions—access to the private data area. (At least classes "know who their friends are.") Friend functions are potentially dangerous because they allow the careless class designer to poke holes into their data-encapsulated wall. So, why is the `ostream` operator designated `friend`? In order to correctly extend the functionality of the

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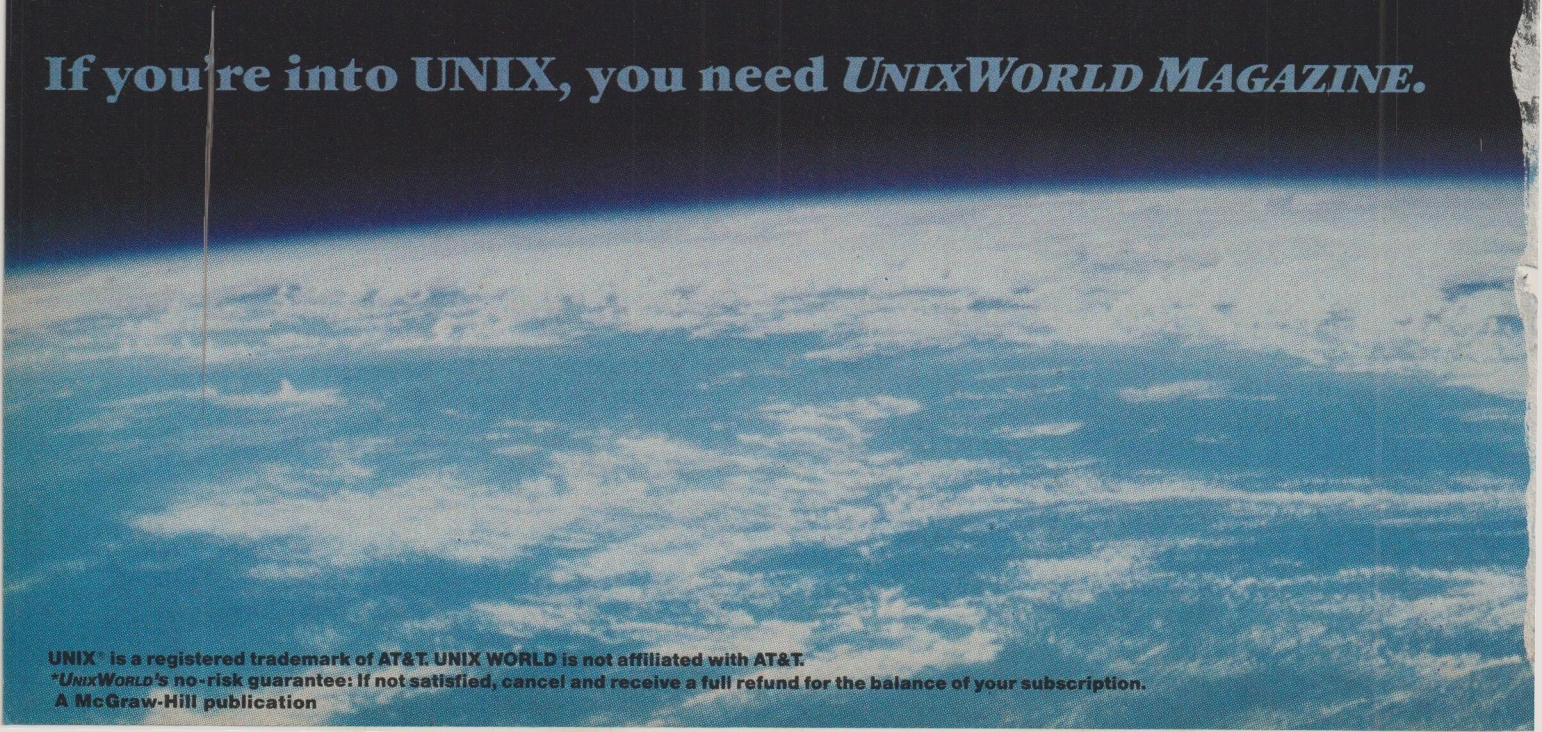

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ostream class, the left operand must be ostream &. To do this, operator << cannot be a member function of class Int. Therefore, if we need to access the private data area of Int, we have to declare the function friend. The istream operator function, however, appears *outside* the class declaration because it does not need to access the Int private data area.

Class Implementation

Listing 2B shows the file Int.C, the implementation of class Int. Because the function definitions are in a separate file from the class declaration, we include the class declaration (in Int.h) using the preprocessor #include directive (line 2).

Range-Checking Constructor. Listing 2B, lines 4-9 define the second constructor (the void constructor was defined inline in Listing 2A), which specifies three integer arguments. The second and third have default values (see Listing 2A, line 19). Again, we specify a member initialization list in order to initialize const int min to minval and const int max to maxval. The body of this constructor makes sure that the user-supplied value (argument v) is within the object's range. Line 7 invokes function badInt() if the argument is out-of-range and line 8 assigns argument v to member data value if the argument is within range.

Copy Initializer. Listing 1A, line 20 initializes Int y with another Int a. Initializing a class object with an object from the same class invokes a special constructor called the "copy initializer." A copy initializer for class Int has the form Int::Int(const Int &), which names a constructor taking a single argument of type constant Int reference.

The compiler uses a copy initializer constructor in three situations:

- When you initialize a new object with the value of an existing object.
- When you pass an object to a function by value.
- When you return an object's value from a function.

If you do not provide a copy initializer and use an object in any of the above situations, the compiler generates one for you. The default copy initializer performs a member-wise initialization of each data member in the class. For example, in Listing 1A, line 20, the compiler initializes y.value from a.value, y.min from a.min, and y.max from a.max. Because a is well-formed, y must be too. The default copy initializer supplied by the compiler is exactly what we want for our Int class.

Destruction. In building a new data type, you should consider whether or not clean-up operations are required such as freeing up heap storage. Because the Int constructors don't allocate any heap storage (using new) or perform any operations that need undoing (like delete), we don't need to provide a destructor.

Assignment Operator. Just like the copy initializer, if you do not define an assignment operator for your class, then the compiler supplies one for you (if you use an assignment expression in your code). The default assignment operator is to perform a member-wise copy of each data item. For example, in Listing 1A, line 38, a default assign-

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ment assigns k.value to j.value, k.min to j.min, and k.max to j.max. There are definitely problems here! First, the constructor has already initialized j.min and j.max (remember, min and max are constants) and the compiler prevents assignments to these data members. Second, even if the compiler did allow this assignment, we stated earlier that we want to keep the range constant. While a given value may be perfectly legal for Int k, it may be outside the range for Int j. Therefore, member-wise assignment is incorrect; it doesn't maintain the integrity of any given Int object.

Listing 2B, lines 12-18 implement the assignment operator for class Int. Remember, the left operand is the invoking object and the right operand is the argument, const Int & i1. The statement (Listing 1A, line 38) j = k calls j.operator=(k). The operator=() function checks to see if the operand's value i1.value is between the object's minimum and maximum (Listing 2B, line 14), and calls function badInt() if there is a range error. Line 16 assigns the new value i1.value to object's value. Note that we do not attempt to modify min or max. Line 17 contains the curious statement return *this.

What's this?

Every member function has access to its invoking object (the object that called the member function). We can refer to an individual data member of the object using the unqualified notation, such as min or value. But what if we want to refer to the entire object? Because we don't have access to its name, C++ provides a predefined pointer to the class type (called this) that's available within every (non-static) member function. For class Int, the predefined pointer is Int * this. Because this is a pointer, an expression such as this->min or this->badInt(v) is valid inside an Int member function. Furthermore, *this is the entire object's value. The statement return *this is equivalent to return j for j.operator=(k).

Chained Assignments. Looking back at Listing 1A, line 45, we find k = i = j. How do multiple assignments like this work? If our assignment operator function returned void, then assignment would work just fine for a single operation, as in i = j. But, by returning an Int &, we allow the result of the assignment to be the operand of a subsequent assignment. (We use Int & instead of Int because it's more efficient.) Thus, k = i = j becomes k.operator=(i.operator=(j)). In order to return the result of the first assignment, we must return the entire object in one statement, using the syntax return *this.

Update Operators. The implementation of the update operators +=, -=, /=, and *= (Listing 2B, lines 20-42) is simplified because they each use the already-defined assignment operator for Int. For example, the implementation for += adds the right operand i1.value to the object data member value, implicitly converts the result of the addition to Int, and uses Int assignment with *this. Remember, the Int assignment oper-

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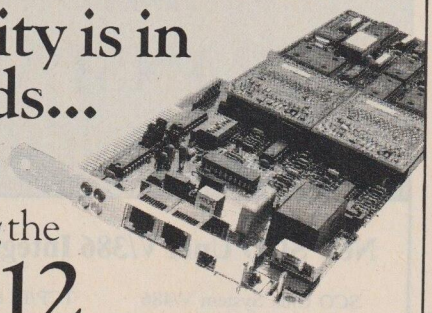

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CIRCLE NO. 44 ON INQUIRY CARD

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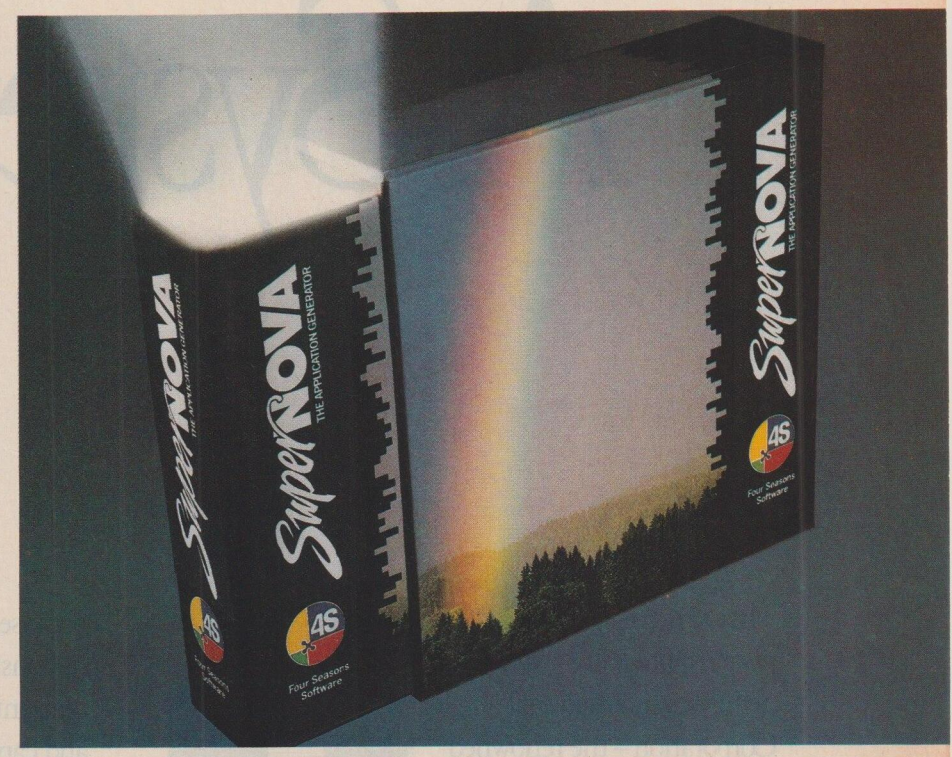

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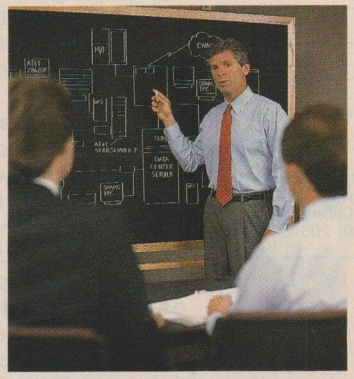

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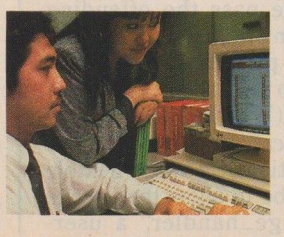

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ator performs the required range checking for the new value of `*this`. Thus, by using `Int` assignment, we don't need to perform range checking in each of the update functions. Like assignment, the update operator functions return `Int &`, which permits chained expressions, such as `b += a += c`.

Increment and Decrement Operators. Listing 2B, lines 45-50 implement the postfix increment operator, which means that the `Int` object is evaluated first and then incremented. In our implementation, we use `Int temp`, initialized in line 47. (We can't return `Int &` from `operator++()` because we would return a reference to local stack storage.) By using the `Int` update operator `+=`, we don't have to check the range within the increment function. (Remember, the update function relies on `Int` assignment, where the range checking is done.) The decrement operator's implementation is exactly the same (Listing 2B, lines 53-58), except we invoke the `Int -=` operator.

Iostream Operators. The input operator `>>` performs integer input (Listing 2B, line 63) and uses `Int` assignment to stuff the value into argument `i1`, guaranteeing that the new value conforms to the range requirements already stored in `Int i1`. Like assignment, we cannot change data members `min` and `max` because they're constants and have already been initialized. The `return` statement allows chained input operators and operands, such as `cin >> a >> j`.

The output operator `<<` (lines 68-73) prints a parenthesized integer triplet consisting of data members `value`, `min`, and `max`. We declared the `ostream` function `friend` to access these private members. Again, the `return` statement allows output chaining, as in: `cout << "a=" << a << ", b=" << b << '\n';` Note that the `iostream` function definitions do not include the scope resolution operator with the class name (`Int::`) because functions `operator>>()` and `operator<<()` are not `Int` member functions.

(Purists may prefer to implement `ostream` operator function `<<` by replacing the direct access to private data with "access" member functions, such as `i1.getvalue()`, `i1.getmin()`, and `i1.getmax()`. These three public member functions can be included in the class declaration file `Int.h` to uphold the strict data encapsulation and eliminate the need for a friend function.)

Run-time Error Handling. Function `badInt()` (Listing 2B, lines 75-80) prints the value (passed in argument `v`) that's out-of-range for the `Int` object. The function also prints the object's range and calls `exit()`. The reason we pass the offending value to function `badInt()` is that the range check is performed before any assignment to or initialization of `Int::value`. (Whether or not you'd like your application to terminate at this point is optional. A more flexible scheme would be to allow the user to supply a "range_handler," a user-

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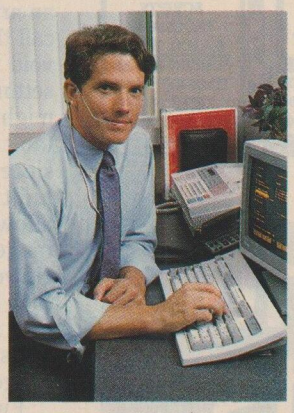

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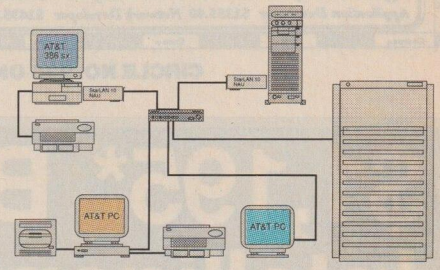

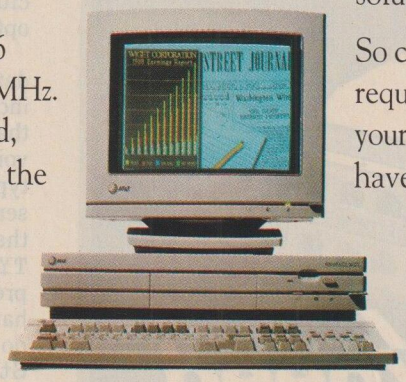

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defined function that class Int calls when range errors occur. We described this technique in last month's article, but leave its implementation to the reader.)

Improvements to Class Int

While our class Int provides an interesting teaching tool, it is not meant to be comprehensive. However, we'd like to give you some suggestions for improving this class and some issues to think about while tackling the task. First, although the implementation of the update and increment and decrement operators shows good code reuse, it's slightly inefficient because of function call overhead and the creation of temporary objects. How might you solve this? Is it really worth solving since class Int is meant to be a debugging tool anyway?

Second, we declare several Ints without initialization values, including an array (see Listing 1A, line 22). Recall that these declarations invoke the void constructor and use the default settings to initialize min and max. One might rightfully argue that these "default Ints" are not terribly useful, since their range is exactly that of a built-in integer. One solution is to allow a user to change the default range. How might you implement this? However, if you have a default range that happens to be very restrictive, how might this affect implicit conversions while manipulating other, larger-ranged Ints?

Finally, it would be really nice to "turn-off" range-checking Ints and use regular integers in production code. The answer probably lies in creative use of the preprocessor to exclude class Int as a compilation option.

The power of creating user-defined data types is exciting. A new type that includes input, output, the "greater than" comparison operator (>), and a void constructor allows us to plug this type into the sorted array class we presented last month. If we change all of the appropriate int declarations to TYPE, for example, and then use the preprocessor to map TYPE to Int, we have a sorted array of Ints! We can do the same thing for a user-defined String class as well (as long as we define the above operations required by the sorted array class). Thus, C++ gives us the tools for creating building blocks with user-defined types.

Next month, we'll examine some of the relationships that exist between classes and how we can use them. ■

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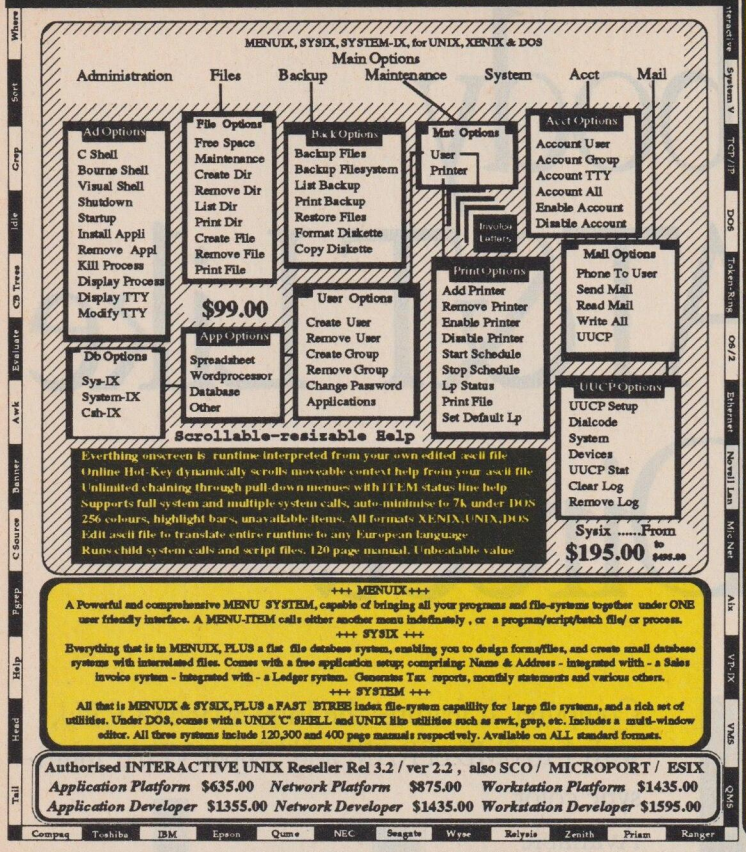

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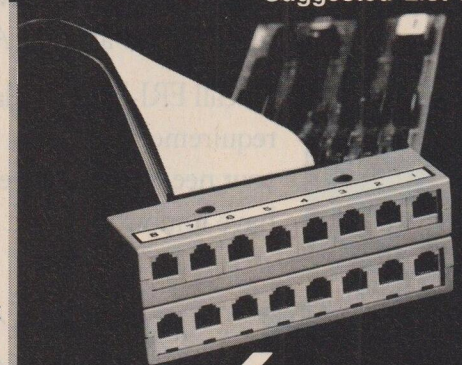

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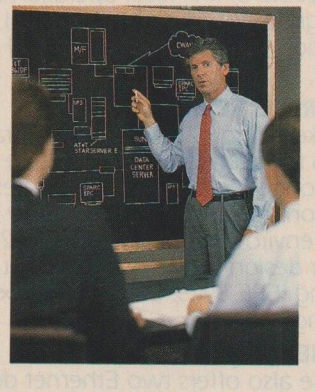

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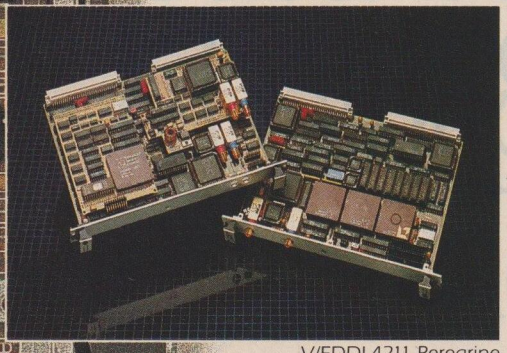

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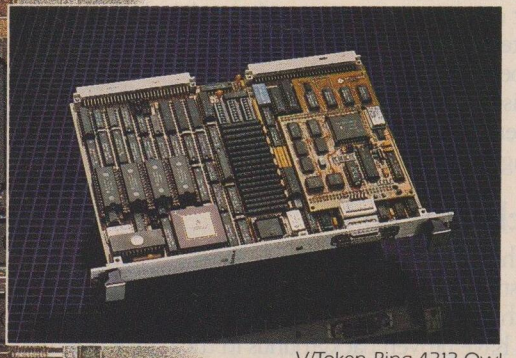

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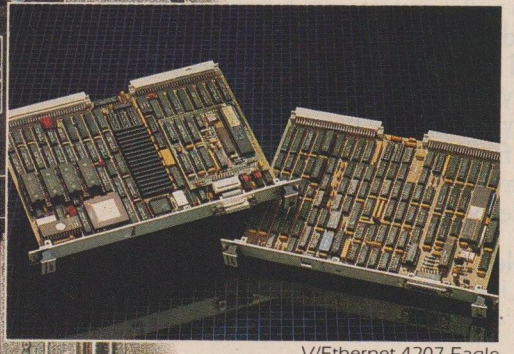

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CIRCLE NO. 212 ON INQUIRY CARD

Dr. Rebecca Thomas

RENAMING FILES, ENSURING DISK SPACE, GROUP PASSWORDS

Hal Stern submits a tool for renaming files that have "illegal" characters in their names. Alan LaPenn provides a shell function useful for determining if there's sufficient space in the target file system to make a file copy. For our security section, Brian Cartmell fills a "hole" in UNIX system functionality by supplying a program to install or change a group file password. For feedback, Keith Wolters suggests a change to the `pdir` phone-directory searching script (published June 1990) to search more than one directory for each script invocation. Enjoy.

Turning Over a New Leaf

Dear Dr. Thomas:

Often novice UNIX users will create files with pathological names. Once extant in the file system, they can produce a variety of bizarre effects—try to invoke any utility on a file with a name beginning with a dash or watch shell pattern matching fail on files with control characters in their names. Even discerning that a single file name has embedded spaces is difficult.

The most frequent cause of poorly named files is confusion about the backspace key, so CTRL-H characters appear in the file name. The `ls` command shows the file name as the user intended it, but attempts to edit or print the file lead to frustration and a call to the system administrator.

The following C program uses the Berkeley-style directory reading routines to scan a directory for file names that contain control characters or start with a leading dash. These files are renamed to `noname`*xNNNNN* (here *x* will be a lower-case letter, and *NNNNN* will be the process-id number of the `fixnames` process) so that the user may peruse or remove them without problems. This program was written on a Sun-3 under SunOS 4.0.

[*Doctor's notes:* Listing 1 depicts the `fixnames` program source code. Because this tool uses the file-system independent directory access routines (listed under `directory(3C)`), it's also applicable to (recent) versions of System V and XENIX systems that support those routines.

Caution. Because the `mktemp()` library routine will create only 26 unique file names per invocation, if there are more than 26 files with "bad" names in the current directory, the surplus will be deleted because `mktemp()` will assign an empty string to its argument.]

[*Author's explanation:* Lines 19-22 check for the existence of an argu-

LISTING 1: The file system independent directory access routines allow you to write a relatively portable program to fix files with "bad names."

```
1  #include <stdio.h>
2  #include <sys/types.h>
3  #include <ctype.h>
4  #include <errno.h>
5  #include <dirent.h>
6  main(argc, argv)
7  int argc; char **argv;
8  {
9      char            *newname;   /* new file name */
10     int             badname;    /* is file name vile flag? */
11     char            *leader;    /* prefix for new file name */
12     char            *p;     /* general character pointer */
13     struct dirent   *dp;    /* ptr to FS-indep. directory entry */
14     DIR             *dirp;  /* stream data struct from opendir() */
15
16     /* initializations */
17     leader = "nonameXXXXXX";
18     /* parse command line option, if given */
19     if (argc > 1) {
20         leader = (char *)malloc(strlen(argv[1]) + 7);
21         sprintf(leader, "%sXXXXXX", argv[1]);
22     }
23     /* open directory and read through it */
24     if ((dirp = opendir(".")) == NULL) {
25         fprintf(stderr, "%s: Can't open current directory\n");
26         exit(1);
27     }
28     for (dp = readdir(dirp); dp != NULL; dp = readdir(dirp)) {
29         /* skip . and .. directory entries */
30         if ((strcmp(dp->d_name, ".") == 0) ||
31             (strcmp(dp->d_name, "..") == 0))
32             continue;
33         /* If name starts with a "-": */
34         badname = (dp->d_name[0] == '-');
35         /* or contains a non-printing char or space: */
36         for (p = dp->d_name; *p != '\0' && !badname; p++)
37             if (!isprint(*p) || (*p == ' '))
38                 badname = 1;    /* it's bad. */
39         if (badname) {  /* if a bad name */
40             newname = (char *)malloc(strlen(leader) + 1);
41             strcpy(newname, leader);    /* affix suffix */
42             mktemp(newname);            /* generate temp name */
43             if (link(dp->d_name, newname) < 0 ) {
44                 perror("Failed to create link");
45                 exit(2);
46             }
```

continued

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Listing 1 continued

```
47              if (unlink(dp->d_name) < 0 ) {
48                  perror("Failed to unlink old file");
49                  exit(3);
50              }
51          }
52      }
53      closedir(dirp);
54  }
```

LISTING 2: Testing for sufficient disk space before making a file copy can save you time. You can use a combination of standard UNIX utilities to perform this operation.

A. Listing of the `enough( )` *function:*

```
1   enough() {
2       USAGE="Usage: enough sourcefile targetdirectory"
3       case $# in
4           2)  if [ ! -f $1 ]; then
5                   echo "\"$1\" doesn't exist or isn't ordinary file."
6                   echo $USAGE >&2 ; exit 1
7               fi
8               if [ ! -d $2 ]; then
9                   echo "\"$2\" doesn't exist or isn't directory."
10                  echo $USAGE >&2 ; exit 2
11              fi ;;
12          *)  echo $USAGE >&2 # Must specify two arguments
13              exit 1 ;;
14      esac
15      FILESIZE=`ls -s $1 | awk '{print $1}'`  # get file size
16      if [ $FILESIZE -gt `ulimit` ]; then
17          echo "File size exceeds ulimit" >&2 ; return 1
18      fi
19      FILESYS=`/etc/devnm $2 | awk '{print $1}'` # get FS name
20      FSLEFT=`df $FILESYS |   # store free block count
21      awk '{ for ( i = 1; i <= NF; i++ ) # look for field
22              if ( $i == "blocks" ) { # containing "blocks"
23                  print $(i-1)    # prior field is free count
24              }
25          }'`
26      if [ $FSLEFT -ge $FILESIZE ]; then   # if enough space
27          return 0                         # return TRUE
28      else                                 # otherwise
29          return 1                         # return FALSE
30      fi
31  }
```

B. Listing of a shell script that I used to test the `enough( )` *function:*

```
1   :
2   # @(#) test.enough  Script to test enough() function
3   # Author: Becca Thomas, October 1990
4   # Read in enough() function definition
5   . enough.fnc
6   # See if we can make a backup copy of kernel:
7   if enough /unix /stand ; then
8       echo "There IS enough space"
9   else
10      echo "There ISN'T enough space"
11  fi
```

ment; if specified, it's used as the prefix for renamed files. After opening the directory (line 24), each entry is examined (loop spanning lines 28-52). If the directory entry is the current (line 30) or parent directory (line 31), it is skipped. Lines 34-38 scan the directory name entry for a leading dash, non-printable (control) characters, and embedded spaces. Appearances by any of these usual suspects results in the file being renamed (lines 39-51).

The `mktemp( )` library routine is used to generate a unique name using the file name prefix passed as an argument. Because `mktemp( )` modifies its argument, the prefix must be reset before each call.]

Hal L. Stern
Sun Microsystems, Lexington, Mass.

Enough is Enough

Dear Dr. Thomas:

I've enclosed a shell function that de-

LISTING 3: Even though both the group file (/etc/group) and System V newgrp command use group passwords, there's no standard UNIX utility for installing or changing them. Here's a program that mimics the passwd command user interface for installing a password for a specified group.

```
1  #include <stdio.h>
2  #include <sys/types.h>
3  #include <grp.h>
4  #define GF_PATH     "/etc/group" /* group file */
5  #define TGF_PATH    "/etc/tmpgroup" /* temporary "group" file */
6  char *sccsID =
7      "gpasswd Install/change group password; Brian Cartmell, 5/90";
8  char keyspace[] =   /* character set for salt */
9    "./0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz";
10 char    grppw[9];   /* file scope group password storage */
11 main(argc, argv)
12 int argc; char *argv[];
13 {
14     char            membrs[250], mems[250], cgrppw[14], salt[2];
15     uid_t           getuid();
16     char            **mp;   /* ptr to group member name */
17     time_t          time(), now;
18     struct group    *grp, *getgrent(), *getgrnam();
19     FILE            *tfp;       /* temporary file pointer */
20
21     if (getuid() != 0) {
22         fprintf(stderr, "Only the superuser can run %s.\n", argv[0]);
23         exit(1);
24     }
25     if (argc != 2) {
26         fprintf(stderr, "Usage: %s groupname\n", argv[0]); exit(2);
27     }
28     if ((grp = getgrnam(argv[1])) == NULL) {
29         fprintf(stderr,
30             "Group %s not found in %s file.\n", argv[1], GF_PATH);
31         exit(3);
32     }
33     printf("Changing password for group %s.\n", grp->gr_name);
34     /* call getpass() until user enters two matching passwords: */
35     while (getgpass() != 0) /* don't match */
36         fprintf(stderr, "They don't match; try again.\n");
37     /* Construct "random" salt: */
38     (void)time(&now);   /* store time since epoch in now */
39     salt[0] = keyspace[now & 077];  /* first char of salt */
40     salt[1] = keyspace[(now >> 6) & 077]; /* second char of salt */
41     salt[2] = '\0'; /* terminate string */
42     /* create encrypted password: */
43     sprintf(cgrppw, "%s", crypt(grppw, salt));
44     /* attempt to open temporary group file */
45     if ((tfp = fopen(TGF_PATH, "a")) == NULL) {
46         fprintf(stderr, "Can't open %s for appending.\n", TGF_PATH);
47         exit(4);
48     }
49     /* Process group file entries one at a time: */
50     while ((grp = getgrent()) != NULL) {
51         for (mp = grp->gr_mem; *mp; ++mp) { /* scan member names */
52             if (*(mp+1)) /* there's another member name */
53                 sprintf(mems, "%s,", *mp); /* copy, add comma */
54             else    /* last member name */
55                 sprintf(mems, "%s", *mp); /* copy, no comma */
56             strcat(membrs, mems);   /* build member list */
57         } /* end for (mp = ... */
58         if (strcmp(grp->gr_name, argv[1]) == 0) /* a match */
59             fprintf(tfp, "%s:%s:%d:%s\n", /* copy w/ new password */
60                 grp->gr_name, cgrppw, grp->gr_gid, membrs);
61         else    /* copy over all other entries verbatim */
62             fprintf(tfp, "%s:%s:%d:%s\n",
63                 grp->gr_name, grp->gr_passwd, grp->gr_gid, membrs);
64         strcpy(membrs, ""); /* reset for next time */
65     } /* end while ((grp = ... */
66     endpwent(); fclose(tfp);    /* done with files */
67     if (unlink(GF_PATH) != 0) { /* Can't delete group file */
68         fprintf(stderr, "Can't unlink %s.\n", GF_PATH); exit(5);
69     }
70     if (link(TGF_PATH, GF_PATH) != 0) { /* Can't link to temp file */
71         fprintf(stderr, "Can't link %s to %s.\n",
72             TGF_PATH, GF_PATH); exit(6);
73     }
```

continued

termines if there is enough room in the target file system to copy a source file to a specified target directory.

I've used this function in various shell scripts that I've created that use large temporary files during processing. While not foolproof, it does provide a measure of prevention that is useful in certain applications.

[*Doctor's notes:* Part A of Listing 2 shows the definition of the `enough()` function and Part B shows the shell script I used to test it. Here, I attempt to copy a large file (`/unix`, the operating system kernel) into the mount-point directory (`/stand`) of the "standalone file system."

Description: Lines 3-14 check that the first argument is an ordinary file and the second is a directory. Line 15 gets the size of the specified source file in blocks and stores it in the `FILESIZE` variable. Line 16 checks to see if the file size exceeds the maximum file size limit (`ulimit` value). If so, line 17 announces the fact and returns one to indicate failure.

Otherwise, line 19 retrieves the device name of the file system where the specified target directory resides and saves it in the `FILESYS` variable. Then, lines 20-25 determine the number of free blocks remaining in the target file system and save the result in the `FSLEFT` variable. The `df` command returns the free block count and inode count, as well as other information. The `awk` program searches for the field that contains the word "blocks" and prints the previous field, which actually contains the free block count. Now we have all the information necessary to determine if there's enough space for the source file in the target file system. Line 26 makes the comparison, and if there's sufficient space, the function returns zero (0); otherwise, it returns one (1).]

Alan LaPenn, New Boston, N.H.

The Security Hole

Because security is becoming more and more important to computer users and administrators, we are providing a minisection of this column devoted to UNIX system security contributions. Please look over the tools on your system and see if you have any that would meet, or could be changed to meet, our publication guidelines (see end of this column).

Passwords for Group File

Dear Dr. Thomas:

My `gpasswd` program was developed

Listing 3 continued

```
74      chmod(GF_PATH, 0444);   /* make group file r--r--r-- */
75      if (unlink(TGF_PATH) != 0) { /* Can't remove temp file */
76          fprintf(stderr, "Can't unlink %s.\n", TGF_PATH); exit(7);
77      }
78      printf("Password change complete.\n");
79  }
80  getgpass()  /* get password from user: */
81  {
82      char    *getpass(); /* returns entered password string */
83      char    pass1[9], pass2[9]; /* storage for passwords */
84      strcpy(pass1, getpass("Group Password: "));
85      strcpy(pass2, getpass("Re-enter Group Password: "));
86      strcpy(grppw, pass2);   /* copy to file scope storage */
87      return(strcmp(pass1, pass2));   /* 0 success */
88  }
```

LISTING 4: The `pdir` script (published in our June 1990 issue) displays on-line phone directory entries that match a supplied pattern. Besides your personal phone list you can include others for which you have read permission.

A. The phone list file that contains a directive to include a general-interest phone list (in `/etc/.phonedir`*):*

```
#include "/etc/.phonedir"
Al Dibernardo<tab>(518) 555-1212<tab>(518) 333-2211
Bill Davidsen<tab>(518) 123-0021<tab>(518) 555-3333
Brian Fitzhume<tab>(517) 123-4567
Dad & Mom<tab>(312) 444-8876<tab>(800) 123-7890
Bill Foo<tab>(408) 331-3456
Denise<tab><tab>(415) 234-6789
```

B. The updated line from `pdir.sh`*, which searches the phone list directory files:*

```
ENTRY=`/lib/cpp -P $PHONELIST | grep "$*"`
```

for System V administrators who want group passwords, but do not have a reliable means of placing such passwords in the group file, `/etc/group`. Sure, you can do so by hand, but it's very easy to make an error. I wrote this program because, although group passwords are used (by `newgrp`), there isn't any utility for installing or changing them. Now all you administrators can stop changing your user password, then cutting and pasting it into the group file.

To use `gpasswd`, log in as superuser, type `gpasswd`, followed by the name of the group. The program will prompt you for a password. It doesn't echo what you type, and like `passwd`, asks you to repeat what you entered to ensure that you didn't make a typing mistake (you can't see what you entered).

[*Doctor's notes:* Listing 3 depicts the `gpasswd` program source code. Note that the salt calculation (lines 38-41) is the same as the one used in John Rushford's `dpasswd` program, published in my November 1990 column.

Personally, I've never used group passwords, and based on discussions I've had with Patrick Wood (co-author of *UNIX System Security*, Sams/Hayden, 1985), I do have a few reservations about such passwords:

- A group with a password can be less secure than one without. Why? Because, if someone guesses the password, then that person can become a member of the group. If there is no group password, the only way one can become a member of the new group (with `newgrp`) is to be listed explicitly in the group file.
- People tend to be less careful with a group password than with their own personal account password. Also, because the password may be known by several people, there's a greater chance that it might be divulged.
- There's no aging mechanism for group passwords, so if not changed on purpose, the same password could be used for the life of the system.
- People could simply disable group permission for their files, making them inaccessible by members of their group anyway.]

Brian Cartmell
Adv. Security Tech. Corp.
Swannanoa, N.C.

Feedback

This section contains selected com-

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The More, the Merrier

Dear Dr. Thomas:

I would like to suggest an improvement to the `pdir.sh` script published in your June 1990 column. The script would be more useful in a workgroup environment if you could share phone directories. One way to do that is to "include" other directory files using the C preprocessor. Simply place one or more `#include "`*pathname*`"` statements in your personal phone directory, where *pathname* names another phone list that you can read. For instance, the first line of the `.phonedir` file located in my home directory reads `#include "/etc/.phonedir"`. The `/etc/.phonedir` file contains entries that anyone here at Wellesley College might be interested in.

[*Doctor's notes:* Part A of Listing 4 shows a sample phone list file containing an include directive, whereas Part B depicts the new line 14, which sets the `ENTRY` variable. The `-P` option tells the C preprocessor, `/lib/cpp`, to suppress output of extraneous line control information. The combined files are then piped into `grep`, which searches for entries matching the pattern argument stored in `$*` , which contains any arguments passed to the script.]

Keith Wolters
Systems Manager, Wellesley College
Wellesley, Mass.

Mail shell scripts, C programs, or tips to ease the burden of system administrators, programmers, and users to: "Wizard's Grabbag," UNIX WORLD, 444 Castro St., Mountain View, CA 94041. Or submit via UUCP to:

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Briefly describe the hardware and software environment (especially the UNIX system version) on which the contributed code was run.

If possible, you should write code that is portable across the popular versions of the UNIX system (System V.X, 4.XBSD, XENIX). Write Bourne or Korn (but not C) shell scripts and use universally available utilities, for example, `who am i` (all systems) instead of `whoami` (Berkeley only). If feasible, use `getopts(1)` or `getopt(3C)` to process command-line options and their arguments.

Use the standard I/O library for structured modular C code. Check source code for nonportable constructions with `lint`. Eliminate hardware dependencies, such as terminal control sequences. (Use `termcap` or `terminfo`.) Isolate nonportable code to one region or a separate module. Keep examples compact (under 100 lines of code with each line less than 65 characters long—counting tabs as 4 spaces) and explanations concise (under 400 words). Use `sed` instead of `ed` scripts, pipelines instead of intermediate temporary files, etc. Be succinct! ■

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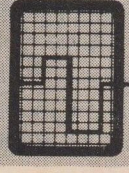

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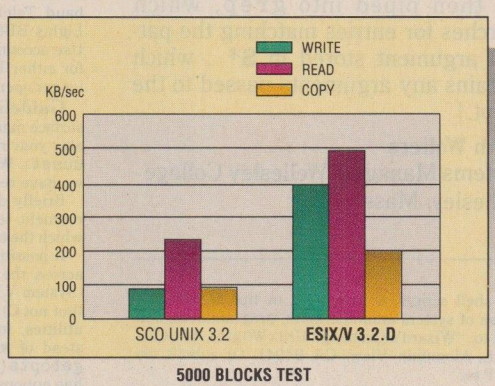

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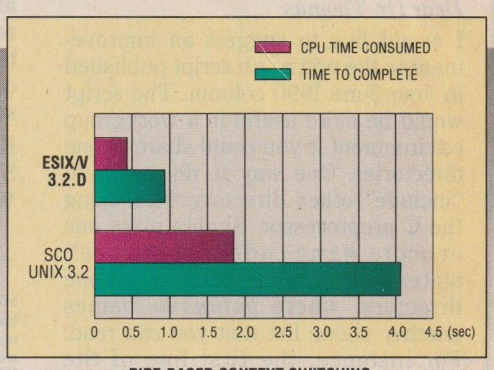

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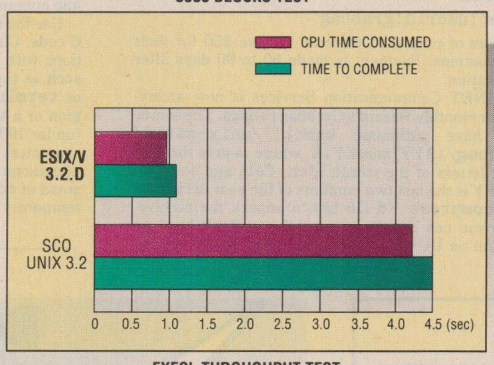

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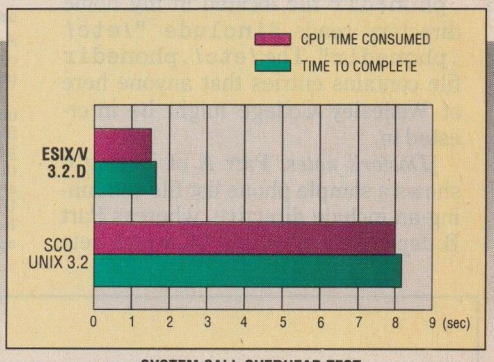

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CIRCLE NO. 124 ON INQUIRY CARD

Ray Swartz

SYMBOLIC LINKS, cu SESSION CAPTURE, BETTER nrm

Our first question this month asks about an `ln` error message that occurs when attempting to create a hard link between two file systems. My response leads into a discussion of symbolic links. The next question wonders if the output of a `cu` session can be captured. Not only can you capture via I/O redirection, but I provide a program to selectively turn capture on and off. For feedback we have a bug fix for the `nrm` script that was published in my June 1990 column.

The Missing Link

Question: Recently I tried to link a shell script between two directories on my BSD UNIX system and got the error message "cross-device link." What is the problem and is there anything I can do about it?

Rhonda Zender
Sunnyvale, Calif.

Answer: To fully describe the problem you had first requires a look at the layout of the Berkeley UNIX file system. For this discussion we can view the file system as composed of three entities: a superblock, an inode list, and data storage blocks. The superblock contains global file system information, such as the total size (in blocks), date of last update, free storage block information, and the file system name (used when mounting).

An ordinary file or directory simply consists of data storage blocks, which can be referred to by number. The size of a data block is a parameter that can be set when the BSD file system is created.

Each file has several items of information associated with it, such as the file type (ordinary, directory, character special, block special, or symbolic link), when the file was last modified or read, how many bytes it contains, who owns it (user and group), the number of links, the file's permissions, and the locations of the storage blocks in the file system. All of this file-specific information is stored in an inode (short for index node).

The directory hierarchy you view as a system user consists of directories that group files and other directories. This hierarchy is held together by links, which provide names for the inodes. Such a "hard link" is implemented as a directory entry, which is an inode number (i-number) paired with a file name. At the shell level you create links with the `ln` command. You can create more than one link for a given inode, using a new file name in the same directory or, if in another directory, the same or different name.

One limitation to creating links is due to the "name space" for i-numbers. Inodes are numbered sequentially starting at one (1) and increase to a limit established when a file system was created. Thus, an i-number is unique only in its own file system. Put another way, if your directory hierarchy consists of more than one file system, then each file system has its own collection of i-numbers (each starting at one).

The "cross-device link" problem is caused by trying to create a link to an inode in a different file system. Consider the problem of allowing cross-device links. Suppose you have several mounted file systems each containing hundreds of inodes. How would the kernel know which file system you were referring to when you requested, say, inode number 2, since all file systems have an inode with this number?

Early UNIX system versions obviated this problem by outlawing such links, thus the "cross-device link" error message. [*Editor's note:* The AT&T-derived `ln` command reports "different file system" for the same

LISTING 1: Symbolic links provide an alternate reference for the name of a file or directory, whereas the conventional "hard" link provides an alternate name for a physical file (inode). Both link types are created using the `ln` command and are distinguishable using the `ls -l` command.

A. Creating a hard link, named `file2`*, for the file,* `file1`*. Note that link count for both files (third field of the* `ls -il` *output) has been increased, but the inode number (first field) remains the same.*

```
$ ls -il file*
   35 -rw-rw-r--   1 root     other     19 Oct  9 17:14 file1
$ ln file1 file2
$ ls -il file*
   35 -rw-rw-r--   2 root     other     19 Oct  9 17:14 file1
   35 -rw-rw-r--   2 root     other     19 Oct  9 17:14 file2
$ □
```

B. Creating a symbolic link, named `file3`*, for the name* `file1`*. The* `ls -il` *listing reveals that the symbolic link is a new file (has a different inode number). The file name for the link (last field) says that any reference to* `file3` *is mapped to the actual file (inode) named* `file1`*.*

```
$ ln -s file1 file3
$ ls -il file*
   35 -rw-rw-r--   2 root     other     19 Oct  9 17:14 file1
   35 -rw-rw-r--   2 root     other     19 Oct  9 17:14 file2
   41 lrwxrwxrwx   1 root     other      5 Oct  9 17:55 file3 -> file1
$ □
```

continued

error condition.] However, being able to link across file systems is useful so BSD UNIX systems introduced "symbolic links" to allow such cross-device links.

Hard links reference an inode, whereas symbolic (or soft) links reference a name. In fact, a symbolic link is implemented as a data file whose data storage block contains the name to which it links. Generally, the name refers to an existing file or directory; however, you could make a symbolic link before you create the file or directory it references!

When you specify the name of a symbolic link file when using a command or system call, it is the file named in the link file, not the link file itself, that is used. Like the hard link, a symbolic link is created using the `ln` command, except that the `-s` option is specified. For comparison, Part A of Listing 1 shows the creation of a hard link, and Part B a symbolic link. Symbolic links are noted in a "long" directory listing (use `ls -l`) with a lowercase "l" as the file-type character (the first character on an output line) as seen in Listing 1B. Note that the file name (last) field shows the reference (or mapping) provided by the symbolic link.

Besides allowing cross-device references, symbolic links allow remapping of file locations. For instance, symbolic links are useful in networked systems that support the mounting of remote file systems. (A remote file system is one that is stored on a machine other than the local system. An example would be a file system mounted over a network using NFS.) A remotely mounted file system might not have the same path name on both machines. Thus, software expecting to find a file with a particular path name must search for it elsewhere. Regardless of where the file system is ultimately mounted, a symbolic link can be made that provides the expected path name.

Symbolic links can be used to remap locations of files in different UNIX implementations, such as between System V and SunOS, and more recently, between Release 3 and Release 4 of System V. Certain system files and directories have been renamed in SVR4, so to provide continuity for commands that reference these files by their old name, symbolic links are provided for the old names that point to the new locations. For instance, `/bin` is actually a symbolic link file that points to the directory `/usr/bin`. Thus, any reference to `/bin` actually refers to the corresponding directory `/usr/bin`. Listing 1C shows a long directory listing for the root directory on my Sun-3/60 running SunOS 4.0.3. Note that `/bin`, `/lib`, and `/sys` are symbolic link files.

Because the symbolic link is a file, it has an inode. Thus, the symbolic link file has its own set of permission modes, owners, and so forth, distinct from the file it references. Initially, the owner and group for the link file will be the same as for the process that creates it. However, the kernel assigns it a particular set of permissions modes independent of the current file creation mask value. My kernel assigns `777` (read/write/execute for all users) mode. These permissions are never used by the kernel to determine file access rights—rather, the permissions for the referenced file are employed.

If you're using the Bourne or C shell, a potential confusion occurs when you change to a directory referenced by a symbolic link and then attempt to move up to that directory's parent. Listing 1D shows an example: From my home directory, `/home/ray`, I create a symbolic link file named `tdir`, which refers to the directory `/var/tmp`. After changing to `tdir` (`cd tdir`), the `pwd` command reveals that my shell is in the `/var/tmp` directory. Now, if I change to the parent directory (using `cd .`), `pwd` says I'm in `/var`, not in the `/home/ray` directory as you might expect.

Listing 1E shows that the Korn shell uses "logical" directory paths instead of the "physical" paths employed by the Bourne and C shells. After changing to `tdir`, `pwd` says I'm in the `/home/ray/tdir` "directory," and after moving up to the parent I'm in `/home/ray`. The "logical" path is perhaps more user-intuitive, but experi-

Listing 1 continued

C. A listing of the root directory on a Sun 3/60 running SunOS 4.0.3.

```
$ ls -l /
lrwxrwxrwx   1 root   wheel        7  Nov 19   1989 bin -> usr/bin
-r--r--r--   1 root   bin     126056  Nov 19   1989 boot
drwxr-sr-x   2 bin    staff     3584  Sep 30 20:27 dev
drwxr-sr-x   5 root   wheel     2048  Sep 30 20:26 etc
drwxr-sr-x   4 root   wheel      512  Nov 19   1989 export
drwxr-xr-x   7 root   wheel      512  Mar 14   1990 home
-rwxr-xr-x   1 root   staff   136185  Apr 24   1989 kadb
lrwxrwxrwx   1 root   wheel        7  Nov 19   1989 lib -> usr/lib
drwxr-xr-x   2 root   wheel     8192  Nov 19   1989 lost+found
drwxr-sr-x   2 bin    staff      512  Apr  9   1988 mnt
drwxr-sr-x   2 bin    staff      512  Nov 19   1989 sbin
lrwxrwxrwx   1 root   wheel       15  Nov 19   1989 sys -> ./usr/share/sys
drwxrwsrwx   2 bin    staff     1024  Oct  2 12:39 tmp
drwxr-sr-x  22 root   wheel      512  Nov 19   1989 usr
drwxr-sr-x   9 bin    staff      512  Apr  9   1988 var
-rwxr-xr-x   1 root   wheel   732281  Nov 20   1989 vmunix
```

D. Illustrating the problem when you've changed directory to a location referenced by a symbolic link and then attempt to change to the parent directory with the Bourne or C shell:

```
$ cd /home/ray
$ ln -s /var/tmp tdir
$ cd tdir
$ pwd
/var/tmp
$ cd ..
$ pwd
/var
$ □
```

E. By default, the Korn shell employs the "logical" path as shown in this example:

```
$ cd /home/ray
$ ln -s /var/tmp tdir
$ cd tdir
$ pwd
/home/ray/dir
$ cd ..
$ pwd
/home/ray
$ □
```

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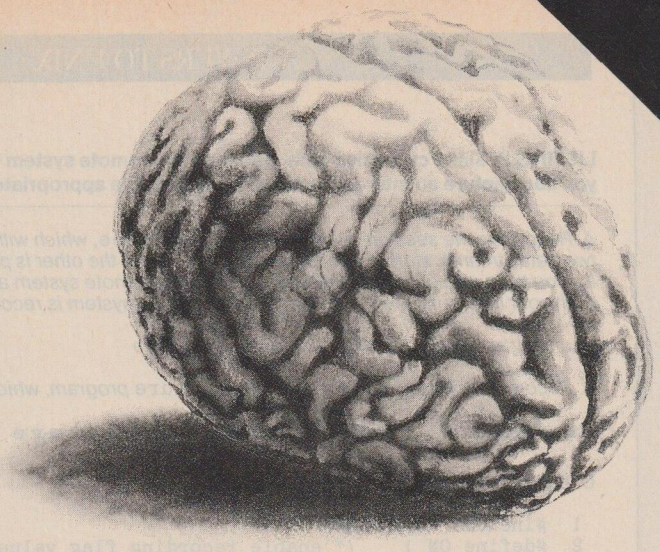

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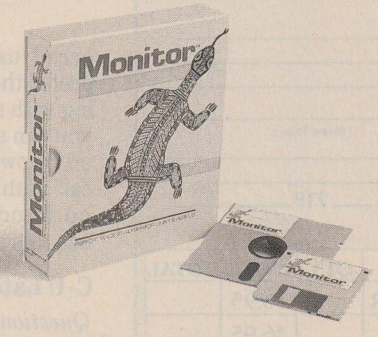

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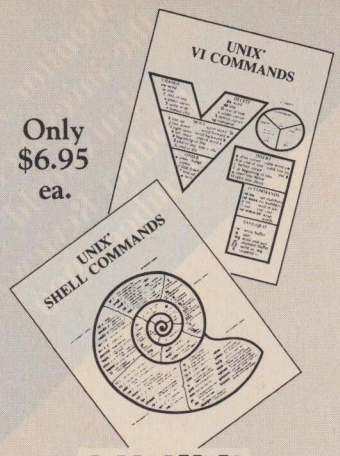

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LISTING 2: Since cu copies data read from the remote system to its standard output, you can capture an interactive session by using the appropriate pipeline.

A. Recording the session by piping cu *output into* tee*, which will split its standard input into two data streams, storing one stream into a file while the other is passed to its standard output for you to see on your terminal screen. Since the remote system also echos your input, both your input and any response from the remote system is recorded:*

```
cu arguments | tee -a capture-file
```

B. Recommended pipeline for using the capture *program, which is listed in Part C:*

```
cu arguments | tee /dev/tty | capture > capture-file
```

C. Listing of the capture *C program:*

```
#include <stdio.h>
#define ON 1    /* enable recording flag value */
#define OFF 0   /* disable recording flag value */
#define CON     "Start Recording"   /* enable recording token */
#define COFF    "Stop Recording"    /* disable recording token */
char *sccsID =
    "@(#) capture Enable/disable cu capture; Ray Swartz, 10/90";
main()
{
    int     recflag = OFF;  /* disable recording initially */
    char    *gets(),    /* declare library routine return type */
            instr[BUFSIZ];  /* I/O line buffer */
    FILE    *tfp,       /* controlling terminal FILE pointer */
            *fopen();       /* declare return type */
    /* Attempt to open controlling terminal for writing: */
    if ((tfp = fopen("/dev/tty", "w")) == NULL) { /* unsuccessful */
        fprintf(stderr, "Aborting, can't open /dev/tty\n");
        exit(1);
    }
    /* Collect input lines and process until end of file: */
    while (gets(instr) != NULL) { /* get line from stdin */
        if (strncmp(instr, CON, strlen(CON)) == 0) { /* ON token */
            recflag = ON;   /* set flag to enabled */
            fprintf(tfp, "Recording enabled\n"); /* announce */
        }
        else if (strncmp(instr, COFF, strlen(COFF)) == 0) { /* OFF */
            recflag = OFF;  /* set flag to disabled */
            fprintf(tfp, "Recording disabled\n"); /* announce */
        } else if (recflag) /* if flag is set */
            puts(instr);    /* copy line to stdout */
    }
}
```

enced users and administrators may prefer the "physical" path. If so, starting with the 1988 Korn shell (ksh-88), you can supply the -P option to either cd or pwd to specify use of the "physical" path. In fact, you may wish to alias cd to cd -P and pwd to pwd -P to use this approach automatically.

C-U Later

Question: I often access a large professional database using the cu remote terminal program. Is it possible to capture the session for use later? And if so, is it possible to selectively enable and disable capture during the interactive session?

David Smith, M.D.
Winter Park, Fla.

Answer: When you're using cu to communicate with a remote system there are actually two instances of cu running—after establishing a connection to the remote system, the parent process forks a child, which reads output from the remote system and writes it to your terminal. Meanwhile, the parent reads input from your terminal and writes it to the remote system. These two processes act in concert to simulate an interactive filter that reads input from its standard input file (attached to your terminal keyboard) and sends output to its standard output file (attached to your terminal screen).

For most applications, cu is run without redirecting its input or output. However, if you want to record a cu session, you can pipe the output of cu into an instance of the tee command that is invoked to send a copy of its standard input to a file (another copy is passed through to its standard out-

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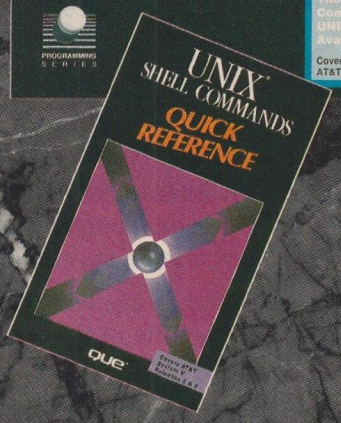

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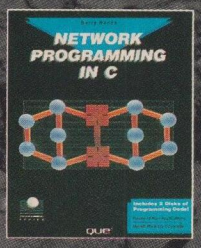

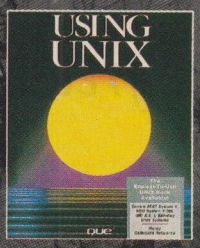

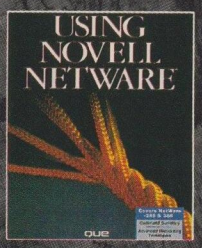

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LISTING 3: Here are enhanced versions of the `nrm` and `erase` scripts originally published in the June 1990 column.

A. Mathew George's version of `nrm`*:*

```
:
# @(#) nrm - move files to .Removed directory
# Written by Ray Swartz, Modified by Mathew George
#
case $1 in
    -*) /bin/rm $*
        exit ;;
esac
if [ ! -d .Removed ]; then
    mkdir .Removed 2>/dev/null
    if [ $? -ne 0 ]; then
        echo "$0: Can't create .Removed directory"
        exit 1
    fi
fi
for fname
do
    touch $fname
    mv $fname .Removed
done
```

B. Listing of the `erase` *script:*

```
:
# erase  Remove the files hidden away by nrm
# Author: Ray Swartz, February 1990
# Modified by Mathew George
if [ $# -eq 0 ]; then
    days=$1
else
    days=1
fi
find . -type d -name .Removed -print |
while read dir
do
    find $dir -mtime +$days -exec /bin/rm {} \;
done
```

C. Listing of `newrm`*:*

```
:
# @(#) newrm - squirrel away files instead of deleting them
# Author: Becca Thomas, October 1990
# Based on scripts by Ray Swartz and Mathew George
#
case $1 in
    -*) /bin/rm $*  # Run "real" rm if option specified
        exit ;;
esac
if [ ! -d $HOME/.Removed ]; then # if no "removed" subdirectory
    if mkdir $HOME/.Removed 2>/dev/null; then # try to make it
        : # do nothing
    else
        echo "$0: Can't create $HOME/.Removed directory"
        echo "Ask your system administrator for help."
        exit 1
    fi
fi
```

put, which is attached to your terminal screen). Listing 2A shows how to establish the pipeline.

The second part of your question, turning the capture on and off, can be accomplished by adding the appropriate program to the pipeline (see Listing 2B). The output of `cu` is piped into `tee`, which is invoked to pass a copy of its input to your controlling terminal (`/dev/tty`) so you can see the intermediate data stream. The standard output from `tee` is piped into `capture`, a program that can toggle the capture function. When recording is enabled, `capture` copies lines read from its input to its output, which has been redirected by the shell into a file, *capture-file*.

You'll need to insert the capture-on

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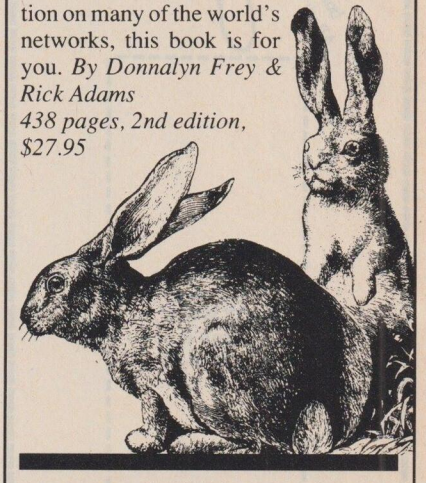

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Listing 3 continued

```
19  for fname   # for all file name arguments
20  do
21      if [ -f $HOME/.Removed/$fname ]; then # file exists already
22          echo "File with name \"$fname\" already in repository."
23          echo "Okay to overwrite (y/n)? \c"
24          read answer
25          case $answer in
26              [Yy]) ;;    # will be overwritten
27              *)  echo "\"$fname\" not overwritten."
28                  echo "If necessary, change name and try again."
29                  continue ;; # process next file, if any
30          esac
31      fi
32      touch $fname    # update modification time
33      mv -f $fname $HOME/.Removed # squirrel away ;;
34  done
```

D. Listing of the `eraseall` *script:*

```
 1  :
 2  # @(#) eraseall  Remove all files hidden away by newrm
 3  # Author: Becca Thomas, October 1990
 4  # Based on script written by Ray Swartz, February 1990
 5  #
 6  DIRLISTFILE=/local/removelist   # File containing directory list
 7  USAGE="Usage: $0 [ days-to-live ]"  # Correct usage message
 8  # Process command-line arguments:
 9  case $# in
10      0)  days=1 ;;   # default life of one day
11      1)  days=$1 ;;  # use specified lifetime
12      *)  echo $USAGE >&2 # only one argument allowed
13          exit 1 ;;
14  esac
15  while read dir
16  do
17      find $dir -mtime +$days -print | xargs /bin/rm 2>/dev/null
18  done < $DIRLISTFILE
```

and capture-off tokens into the pipeline data stream. If the remote system runs UNIX, you can use the commands: `echo "Start Recording"` to enable capture and `echo "Stop Recording"` to disable it. Recording is also disabled when you terminate the remote session, as the shell will close the *capture-file* automatically. If the remote system doesn't have `echo`, then run some other command that will write the capture-on and capture-off tokens into the pipeline.

The `capture` program, shown in Listing 2C, reads its standard input and copies it to its standard output if the `recflag` variable is set to `ON` (the value 1). Note that this variable is set to `ON` (line 23) if the capture-on token, here represented by the line "Start Recording," is read and `recflag` is set to `OFF` (line 27) when "Stop Recording," the capture-off token, is read. We used `strncmp()` to compare the token to the text at the beginning of the input line because `cu` appends a CTRL-M to the end of line.

I arbitrarily chose "Start Recording" and "Stop Recording" as my on and off tokens. Obviously, these might appear naturally in the `cu` session. Because any string of characters can be used for these tokens, feel free to use any that seem more appropriate for your purposes.

Removing problems with nrm

In my June 1990 column, I wrote a Bourne shell script named `nrm`, which was designed to replace `rm` with a nondestructive command that moved files to a `.Removed` subdirectory for permanent deletion later by a companion script named `erase`. By default `erase` would remove all files in the "removed" subdirectories older than one day. Mathew George sent me some ideas on improving `nrm`:

"I implemented the `nrm` script but lost a few files because of a small flaw. Although `nrm` moves the files to the `.Removed` subdirectory, `erase` even deleted some files moved less than a day before. This problem arises because `mv` doesn't update a file's modification time. Thus, `erase` removes any files that haven't been modified in the last day, regardless of when they were moved to the `.Removed` directory. A simple fix to `nrm` solves the problem—

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update the file's modification time with `touch` before moving it.

In addition, sometimes I need to invoke `rm` with an option, but can't do so after I've aliased `rm` to `nrm`. So, I modified `nrm` to run `/bin/rm` if any options are passed as the first argument. I also modified `erase` so it would start with the current directory instead of the root directory (`/`), which reduces the risk of removing other users' files by mistake."

[*Editor's notes:* Parts A and B of Listing 3 depict the `nrm` and `erase` scripts provided by Mathew George. One enhancement I'd recommend—to recover inodes, add a command after line 13 in Listing 3B to delete the `.Removed` directory, which `rmdir` will do if it's empty.

I've provided a version of `nrm` named `newrm` (see Listing 3C) where all files are moved to a single location subordinate to the user's home directory, which avoids creating a large number of "removed" directories scattered throughout the user's directory tree and (possibly) consuming a significant number of inodes. However, now that all files are moved to the same place, I needed to ensure that the user didn't overwrite an existing file with another that happened to have the same base name. Thus, the additional test and user interaction provided by lines 21-31.

The `erase` script that Mr. George supplies isn't appropriate for invocation by `cron`, as the current directory would be the root directory anyway. So, I've provided another version of `erase` named `eraseall` (see Listing 3D), which only examines a list of home directories set up by the administrator. The `eraseall` script should be used if you decide to run `newrm`.]

Caution: There's a risk in changing the functionality of a standard UNIX command. Then, the environment you're accustomed to is not the "standard" one. So, you can lose a file if you run `rm` on another system (that doesn't redefine `rm` to run `nrm`) with the cavalier attitude that if a file is removed by mistake, it can be retrieved.

Guidelines: Obviously, this column won't be of much interest unless you send us your questions. Try to make your questions as general interest as possible, and, please, no questions regarding specific hardware or third-party application packages. State the UNIX system version, if applicable, for the question at hand. Send your questions by surface mail to Ray Swartz, "Answers to UNIX," c/o UNIX WORLD magazine, 444 Castro St., Mountain View, CA 94041. Or send them via e-mail to:

`uunet!uworld!ans2unix`

Please remember to include your surface mailing address and telephone number. ■

Ray Swartz is the founder of Berkeley Decision/Systems, which specializes in C and UNIX training. His first book discusses using C for business applications, and his second book teaches shell programming using business-related examples.

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UPCOMING SHOWS

The Second Berlin UNIX Forum: February 11-12
The Berlin UNIX Forum aims to build a user-oriented professional association in Germany so that users can easily understand the technologies of open systems, and support the exchange of information among different interest groups. The topic of open systems will be discussed in lectures and tutorials. Special attention will be given to the interests of professionals in the field of data processing of the local administration. The program will concentrate on standardization, office systems, distributed systems, and object-oriented programming languages.

More than 40 exhibitors from Austria, Switzerland, and the United States, and including first-time participants from Hungary, Poland, Czechoslovakia, and the Soviet Union, are slated to attend. An annual meeting of the EAG-UNIX producer/user group of the old GDR is also scheduled. The conference will be held in Berlin, Germany. Contact Nico M. Klauke, Uniware# Computer GmbH, +49-30-31-0009-246.

Business Solutions Showcases: February 19
The Solutions Showcase is to exhibit the latest computer automation products to business leaders, and to provide a clearer picture of definite business automation solutions available now and in the future. On exhibit are presentations on computerized accounting systems, local-area networking, and XENIX multiuser platforms. The PC companies scheduled to attend are: The Santa Cruz Operation (XENIX multiuser solutions); Novell (networking solutions); RealWorld (accounting software and wholesale/distribution solutions); National Software (automotive after-market solutions); Cougar Mountain (fund accounting solutions); Streetgard Software (police and fire department solutions); and Synchronics (point-of-sale solutions). The showcase will be held in Fort Lauderdale, Fla. Contact your local Radio Shack Computer Center.

CommConn '91: February 25-27
The theme of this conference is "Telecommuting–Beating Traffic and the Competition." This is the first exposition and conference dedicated to new communication technologies available through public-access telephone systems, without leased lines. More than 120 professionals are slated to address issues on telecommuting. The sessions will include five tracks: "Understanding the New Communication Technologies," "Implementing New Communication Technologies and Software," "Human Resource Issues in Telecommuting and Enterprise Networking," "Integration of Communications and Computing Resources," and "Strategic Benefits of Integrated Communications and Computing."

On the schedule with CommConn '91 will be North American ISDN Users' Forum, which will feature dozens of sessions and workshops about the technical protocols associated with ISDN. The conference will be held at the Town & Country Hotel, San Diego, Calif. Contact Frank Tyson Dimensions, 415-637-2300.

Chief Networking Officers' Forum: March 4-6
The forum's aim is to address the strategic planning and management needs of large, networked enterprises. Its focus is on the critical decisions and choices facing the individual who heads the corporate communications organization.

The forum presents a series of topics dealing with chief networking officers' duties: strategic and tactical planning; technology appraisal and application; and management and business. Among the scheduled topics are perception of the network as a support function, or as a corporate asset; single vendor vs. multivendor solutions; politics and management of downsizing; internetworking capabilities and technologies; and management solutions vs. technological solutions. Dr. Dixon R. Doll, founder and chairman of the DMW Group, will chair the CNO Forum. The Forum will be held in Washington, D.C. Contact the Technology Transfer Institute, 213-394-8305.

Seybold Seminars '91 Professional Publishing Conference: March 4-7
This conference targets users and vendors of professional publishing systems. It will contain extensive analysis of new technologies that affect all phases of

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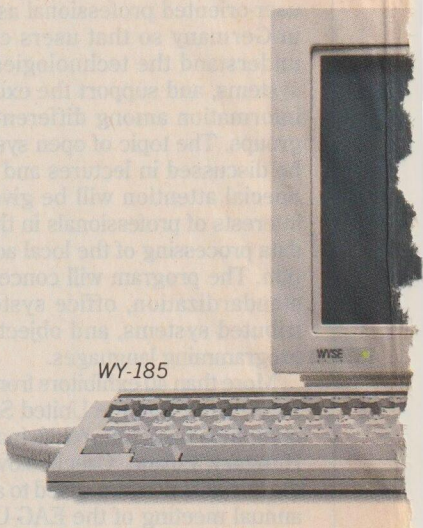

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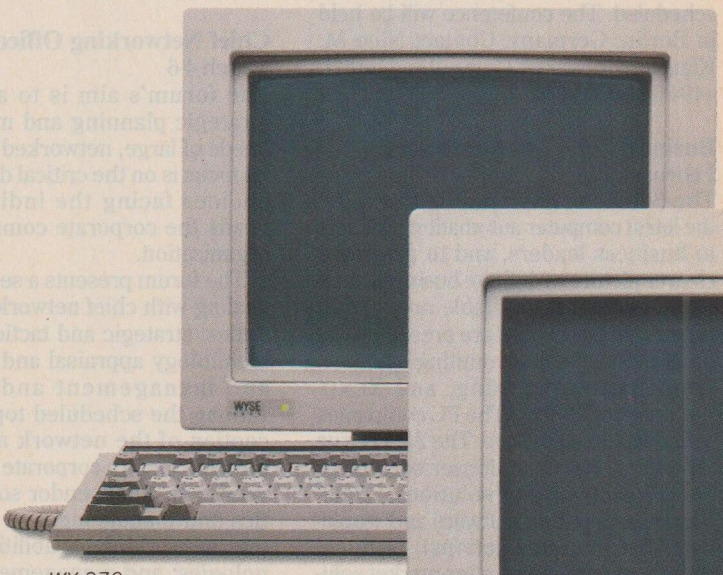

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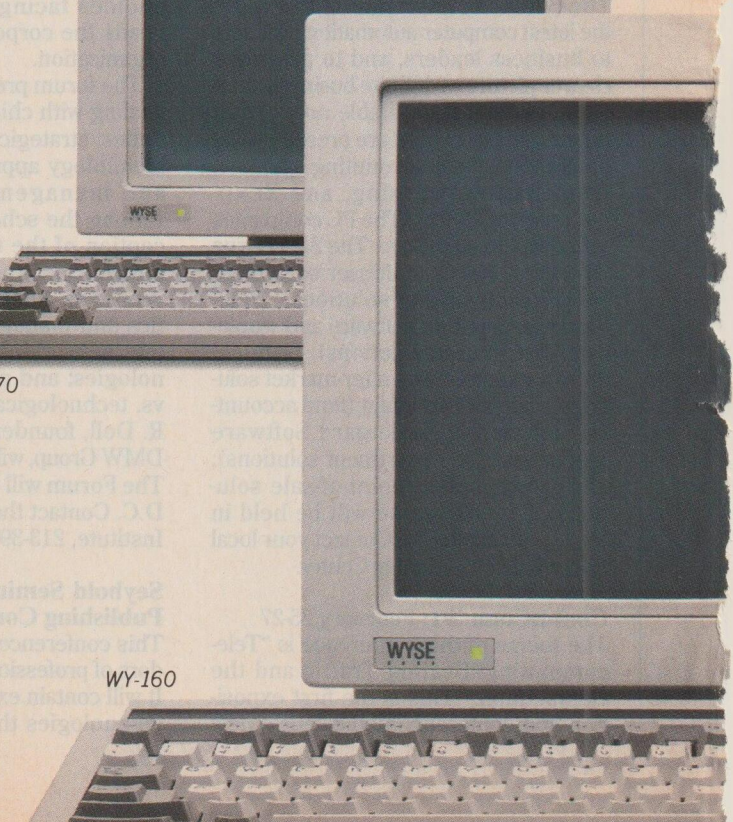

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As Sun makes the transition from computers based on the VMEbus standard to the S-Bus standard, third-party vendors are jumping in with products to ease the users' migration. Performance Technologies' PT-SBS915 S-Bus-to-VMEbus Adapter includes an S-Bus board, a VMEbus board (in 6U or 9U format), and a 10-foot or 20-foot shielded interconnecting cable, allowing newer workstations to be integrated into environments dominated by VMEbus-based workstations, and enabling users to protect their investment in VMEbus-based applications.

You can initialize the adapter with an on-board EPROM; it comes with a floppy disk that lists all the attributes of the EPROM so that you can customize the adapter for specific applications. The adapter works in two modes: compelled, at six megabytes-per-second throughput, and non-compelled, at 12 megabytes-per-second throughput.

You can also configure the adapter so that each board can operate as both master and slave, using an ASIC interface. Price of the PT-SBS915 is $1,995 per set, including 10-foot cables, in quantities of 100. **Performance Technologies, 435 W. Commercial St., E. Rochester, NY 14445; 716-586-6727.**

Circle No. 302 On Inquiry Card

Rat-A-Tat DAT

If you're interested in turning out tape copies of backup data or software updates, Duplication Technology's Echo-4000 Tower uses Archive's Python 5 1/4-inch DAT (digital audio tape) drives to duplicate from two to eight 4-mm tape cassettes simultaneously, each with up to two gigabytes of storage. You can also attach additional cabinets to duplicate 12 tapes at a time, or attach a disk drive to copy from disk to tape or from tape to tape. Using a separate keyboard and monitor, menu-driven software leads you through the duplication process. Prices range from $24,200 for a two-drive configuration to $60,800 for an eight-drive configuration. **Duplication Technology, 2830 Wilderness Pl., Ste. E, Boulder, CO 80301; 303-444-6157.**

Circle No. 303 On Inquiry Card

Behind The Eight Ports

You can add eight asynchronous RS-232 ports to your SPARCstation by installing a Sigma Information Systems' SBM8 multiplexer in the S-Bus slot. You can use two multiplexers for 16 channels, one channel for each serial line device, whether a modem, terminal, printer, or plotter. You can program the line parameters and transmission rates (up to 38.4K baud) for each channel. On-board the multiplexer is a DMA (direct memory access) controller chip to handle throughput while accessing the host CPU as little as possible. List price is $1,112; quantity discounts are available. **Sigma Information Systems, 3401 E. La Palma Ave., Anaheim, CA 92806; 714-630-6553.**

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This Bus Transfer Is Made Of Fiber

Augment Systems' fiber-optics links connect workstations using a variety of buses, including VMEbus, NuBus, and Digital's Unibus, Q-bus, and DRV11-W bus. Using the AL 100 products, you can set up direct, high-speed, point-to-point links between workstations and computers. Each link uses two channels that both operate in full duplex mode, and communications can occur from either end. Address translation techniques map segments of the local memory using a "window" into the remote machine's end-address space.

Once you've initialized the links, the memory cycle times dictate how fast blocks of data can be transferred; the company estimates a typical throughput time as four megabytes per second. Prices for the VMEbus and NuBus links are $3,699; for the Digital bus links, $2,519. **Augment Systems, 19 Crosby Dr., Bedford, MA 01730; 617-271-0230.**

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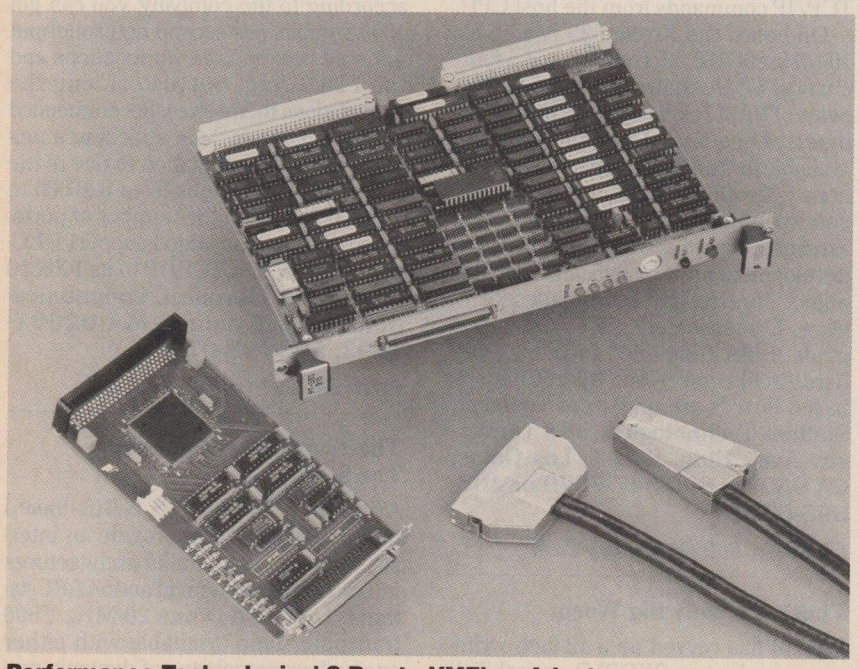

Performance Technologies' S-Bus-to-VMEbus Adapter

Videos Through Software

Paradise Software's Videophile is a software-based video solution that, using Parallax Graphics' VideoView board and a SPARCstation, lets you digitize video input, store it on magnetic or optical disk, and play it back on the workstation at 24 or 30 frames per second. Videophile consists of three utilities: capture, compression, and playback. The capture utility uses the Parallax card to digitize the video data, while the compression utility compresses video and audio data into a single file (compressed, the video data requires about 150 kilobytes of storage per second of real-time video). The playback utility decompresses the data and lets you play it back.

Besides being available as a standalone development kit, Videophile can also be purchased as part of Paradise's HyperCmedia toolkit, an API (application programmer interface) for developers to create hypertext or hypermedia applications. Now in version 2.3, the HyperCmedia toolkit has added support for Sony and Pioneer videodisc players, automatic construction of browsing links, a "snapshot" capability for setting aside information for future reference, and visual icons for each of the pages. The Videophile toolkit is $1,995 (run-time licenses, comprised only of the playback utility, are $200). **Paradise Software, RD1, Box 467A, Lambertville, NJ 08530; 609-397-4142.**

Circle No. 306 On Inquiry Card

I Get My CICS From UNIX

You can now develop UNIX applications compatible with IBM's CICS on-line transaction processing (OLTP) environment using Unicorn Software's UniKix; you can use it to execute Cobol applications developed for CICS on IBM mainframes. UniKix is designed to allow migration of applications from mainframe environments to UNIX workstations without source code modification. It offers compatibility with CICS' most common control and system commands, and includes a screen generator, BMS assembler, VSAM file manager, table manager, command translator, symbolic debugger, OLTP executive, and Cobol applications interface.

UniKix runs under UNIX System V.3 with the UNIX version of Micro Focus' Cobol/2 compiler. Platforms include Arix, NCR, Nixdorf, Sequent, Unisys, and Sun. Prices range from $7,500 for a five-user version to $75,000 for the minicomputer version. **Unicorn Systems, 701 N. Brand Blvd., Ste. 400, Glendale, CA 91203; 818-549-1999.**

Circle No. 307 On Inquiry Card

Bringing the IBM S/370 Into NFS

Following on its other TCP/IP-to-IBM connectivity software products, Interlink's SNS/NFS software lets you connect IBM S/370 mainframes running the MVS (multiple virtual storage) operating system as a network server on your NFS (network file system) network. Besides working with Interlink's SNS/TCPaccess and SNS/API, the software lets you use security packages like RACF, ACF2, and Top Secret in the NFS environment, and it lets NFS users access IBM data. Cost of the software is $9,950. **Interlink, 47370 Fremont Blvd., Fremont, CA 94538; 415-657-9800.**

Circle No. 308 On Inquiry Card

Stallion Trots Out An X.25 Connection

Stallion Technologies' Xtream-25 AT-bus-based network co-processor lets you link a PC running UNIX into a wide-area network that uses the X.25 protocol. The board has a real-time operating system based on AT&T's Streams communications module, which processes protocols and manages serial data as well. Using this operating system, the board can off-load high-level network layers (such as Open System Interconnection) and in some cases also off-load TCP/IP commands from the host CPU.

On-board the Xtream-25 is a 16-bit 16-MHz 80C186 microprocessor, a four-channel DMA controller, and 512 kilobytes of RAM (expandable to one megabyte). A protocol development kit is available for the development of applications with other communications protocols (such as SDLC or Bisync). The Xtream-25 board is $1,095; the protocol development kit is $2,395, and includes object libraries for downloaded firmware, C source code files, and user's guide. EISA (Extended Industry Standard Architecture)- and MicroChannel-based boards are under development. **Stallion Technologies, 983 University Ave., Bldg. B-104, Los Gatos, CA 95030; 800-347-7979 or 408-395-5775.**

Circle No. 309 On Inquiry Card

That's A Really Big Worm

Hitachi has revved up a 12-inch write-once, read-many (WORM) optical disk drive, the OD321, that stores up to seven gigabytes of data and can access data at a sustained transfer rate of up to 2.2 megabytes per second. Using a separate printed circuit assembly, users can install either single-ended SCSI (Small Computer Systems Interface) or differential-ended SCSI on the drive, while a "cross-call" function lets the drive communicate with two separate SCSI controllers–i.e., two separate SCSI buses–at the same time.

The increase in capacity comes from an access method that lets the drive's laser diode read not only the "readout hole" where the data resides but also the edges of the readout hole. Price of the drive in OEM (original equipment manufacturer) quantities is $15,000. Also available are two jukebox configurations. With one or two drives, you can hold up to 64 disks, for a total of 448 gigabytes of data; with one to four drives, you can hold up to 47 disks, for 329 gigabytes of data. Price is $85,000 in OEM quantities. **Hitachi, 2000 Sierra Point Pkwy., Brisbane, CA 94005; 415-589-8300.**

Circle No. 310 On Inquiry Card

Ethernet to FDDI, Come In Please

You can connect up to 12 workstations via twisted-pair (10baseT) Ethernet to Fibronics' FX8610 Workstation Communication Server, which in turn connects to an FDDI (Fiber Distributed Data Interface) network. Through circuitry and software within the server, according to the company, you can get 100 megabits per second of throughput not only between the workstations and the FDDI ring, but also among the workstations themselves. Recommended configurations include attaching a network management station to one of the 12 ports. Price ranges from $20,000 to $30,000, based on the number of ports. Fibronics has also added support DECnet Phase IV and TCP/IP to its FX8310 FDDI router. **Fibronics, Communications Way, Hyannis, MA 02601-1892; 508-778-0700.**

Circle No. 311 On Inquiry Card

The Transputer Comes To The S-Bus

Archipel's Volvox 1/S S-Bus-based board is designed to provide an interface between the parallel architectures Inmos transputers run in and SPARCstations. On-board is one 20-MHz T800 transputer chip, available with either one or four megabytes of dynamic ran-

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1. What is the extent of your networking activity within your company or organization? (check all that apply)
❑ A. Planning and Development
❑ B. Design and Implementation
❑ C. Management
❑ D. Other (Specify) _____
❑ E. No Involvement

2. Which of the following best describes your involvement in the purchase of data communications and networking equipment and services? (check all that apply)
❑ A. Specify
❑ B. Recommend
❑ C. Purchase
❑ D. Approve Purchase
❑ E. None

3. Which is your company's primary business activity at your location? (Check only one)
❑ A. Manufacturing: Computers/Communications
❑ B. Carrier: Including AT&T, B.O.C.s, Independent Telcos, Public Data Networks
❑ C. Value Added Reseller/Dealer, System House/Distributor, Interconnect Company, Integrator, Computer/Communications
❑ D. Computer/Communications Services: Software, Service Bureaus, Time Sharing
❑ E. P.T.T.
❑ F. Other Manufacturing (other than Computers/Communications)
❑ G. Trade: Wholesale/Retail
❑ H. Finance: Banking, Real Estate, Insurance
❑ I. Transportation
❑ J. Utilities: Gas & Electric
❑ K. Government: Federal, State, Municipal & County
❑ L. Medical/Legal/Education
❑ M. Consulting
❑ N. Other _____

4. What is your job function? (check only one)
❑ A. Networking Operation, Planning or Management (including Data Communications Management)
❑ B. MIS/DP Operations, Planning or Management
❑ C. Corporate Management
❑ D. Networks/Systems Implementation
❑ E. Systems Integration
❑ F. Other _____

5. In what department do you work? (check only one)
❑ A. MIS/DP
❑ B. Communications/Networking
❑ C. Corporate/Administrative
❑ D. Finance/Accounting
❑ E. Engineering
❑ F. R&D
❑ G. Manufacturing
❑ H. Sales/Marketing
❑ I. Operations/Production
❑ J. Purchasing
❑ K. Distribution
❑ L. Education/Training
❑ M. Technical Support
❑ N. Consulting
❑ O. Other _____

6. What is your job title?
❑ A. Chairman, President, Owner, Partner, CEO
❑ B. Vice President, MIS/DP/Networking/Communications
❑ C. Vice President (all other VP's)
❑ D. Director, Department Head
❑ E. Manager, Supervisor
❑ F. Engineer
❑ G. Consultant
❑ H. Other _____

7a. How many Local Area Networks (LANs) are presently installed within your company/organization?
❑ A. More than 20
❑ B. 10-20
❑ C. Less than 10

7b. How many Local Area Networks (LANs) will be added over the next 12 months? (check only one)
❑ A. More than 20
❑ B. 10-20
❑ C. Less than 10

8. Is your network: (check only one)
❑ A. Local (within building/campus)
❑ B. Metropolitan
❑ C. Regional (several states)
❑ D. National
❑ E. International
❑ F. Other _____

9. Does your company's network include: (check all that apply)
❑ A. Local Area Network (PC LANs)
❑ B. Minicomputer based LANs
❑ C. Mainframe LAN (micro to mainframe, mini to mainframe)
❑ D. Wide Area Network (including public data network)
❑ E. Public Network (including public data network)
❑ F. Bypass Network (private network)
❑ G. Other _____

10. Estimate value of network equipment and services:

A. Which you helped specify, recommend or approve in the last 12 months?

B. Which you plan to help specify recommend or approve in the next 12 months?

A	B	
❑	❑	$20 million or over
❑	❑	$10 million to $19.9 Million
❑	❑	$5 million to $9.9 million
❑	❑	$1 million to $4.9 million
❑	❑	$500,00 to $999,999
❑	❑	$250,000 to $499,999
❑	❑	$100,000 to $249,999
❑	❑	$50,000 to $99,999
❑	❑	under $50,000
❑	❑	None of the above

11. Which products and/or services do you help acquire, recommend, specify or buy? (check all that apply)

NETWORKING EQUIPMENT
❑ A. Local Area Networks
❑ B. Modem (9.6 KBPs and over)
❑ C. Modem (under 9.6 KBPs)
❑ D. T-1/T-3 Equipment
❑ E. PBX/Data PBX (including data switches)
❑ F. Bridges/Routers/Gateways
❑ G. Packet Switches
❑ H. Network Management Systems
❑ I. Central Office Switches
❑ J. Fiber Optic Equipment
❑ K. Multiplexers

SERVICES
❑ L. Local Service
❑ M. Long Distance Service
❑ N. Public Data Network Service
❑ O. Dedicated Leased Line
❑ P. Centrex
❑ Q. Central Office LAN
❑ R. Satellite
❑ S. Fiber Optic
❑ T. Packet Switches
❑ U. ISDN Service

SOFTWARE
❑ W. Network Operating Systems
❑ X. Network Management
❑ Y. Communications Software
❑ Z. Applications Software
❑ 1. Call Accounting
❑ 2. Systems Software

COMPUTERS/PERIPHERALS
❑ 4. Microcomputers
❑ 5. Minicomputers
❑ 6. Mainframe
❑ 7. Front End Processors
❑ 8. Terminals
❑ 9. Printers

❑ 10. None of the above

12. What is the estimated annual revenue of your company? (check only one)
❑ A. $1 billion and over
❑ B. $500 million to $999 million
❑ C. $100 million to $499 million
❑ D. $50 million to $99 million
❑ E. under $50 million

13. How many employees are in your company? (check only one)
❑ A. 5,000 employees and over
❑ B. 1,000-4,999 employees
❑ C. 500-999 employees
❑ D. under 500 employees

MLL0000

dom access memory (DRAM), which lets you use the SPARCstation as a development workstation, as a parallel processing device, or to provide access to a transputer-based network. Also available: Archipel's software integration tool, Volvox-Par, which provides the interface between SPARC programming languages and the Inmos transputer. Cost is $4,000. **Archipel, 4 Route de Nanfray, 74000 Annecy, France; 3350-692058 (voice) or 3350-692065 (fax).**

Circle No. 312 On Inquiry Card

Taming The Network Smorgasbord

With Racal Interlan's InterNext 5000 communications system, you can integrate in one box the connections for Ethernet concentrators and asynchronous terminal servers, and manage it all with the simple network management protocol (SNMP). The system supports Ethernet on coaxial cable or twisted-pair, and fiber-optics cable as well; the company also offers a fiber-optics interrepeater link (FOIRL) to link InterNext 5000 systems by fiber-optics backbone.

Instead of a backplane design, the system has a midplane, which enables integration of dual-protocol terminal servers and 10baseT concentrators in the same chassis. The midplane also allows a dual Ethernet bus for increased speed and reliability. Besides fault-tolerant power distribution and redundant management modules, there is also a distributed power supply whose components can be replaced while the system is running. A base unit of the InterNext 5000 with 12 slots is $4,250, with 3 slots, $2,550; a 16-port terminal server module is $2,995, and includes both LAT and TCP protocol software. A 12-port 10baseT concentrator module costs $2,125, and the SNMP network management software is $3,350. **Racal Interlan, 155 Swanson Rd., Boxborough, MA 01719; 800-LAN-TALK or 508-263-9929.**

Circle No. 313 On Inquiry Card

In Search Of The Perfect Solution

PerfectSolution Software UNIX version supports global full-text searching on any network node across local- and wide-area networks, in servers or databases. You can also limit the scope of the search to any combination of up to four LANs or WANs. PerfectSolution for UNIX keeps track of key information (through a profiling system) that lists author, typist, creation date, document type, and application, so you can search for information either by the text you're looking for or by document profile characteristics.

The software also includes three fundamental utilities. A document import feature lets you profile existing documents, whether they're word processing files, spreadsheets, CAD drawings, or graphs. Its dynamic document maintenance feature correlates the document profile and its location automatically, so that users can create new directories, and move and rename documents without having to do it manually. The version control feature allows multiple versions of a single document to be created, previewed, copied, edited, and compared, with profiles within PerfectSolution still maintained. Cost is $3,995 per server, plus $295 per user. **PerfectSolution, 625 S. State St., Orem, UT 84058; 801-226-6000.**

Circle No. 314 On Inquiry Card

Mach & Mac Together Again For The First Time

Tenon Intersystems has put the Macintosh graphical user interface (GUI) on top of the Mach version of UNIX to come up with Mach-Ten. An implementation of Berkeley UNIX built on a foundation of Carnegie-Mellon's Mach, Mach-Ten runs as an application on the native Macintosh operating system. It comes with 300 UNIX programs and a Mach kernel, which supports the standard UNIX applications environment (this environment also allows all standard Macintosh programs to run simultaneously with UNIX programs). According to Tenon, the software brings to the MacOS internet communications, NFS distributed communications, and UNIX's multitasking. The software runs on all Macintosh computers, from the Classic to the Macintosh IIfx; price is $595 for a two-user license, or $835 for an unlimited-user license; documentation is $175 extra. **Tenon Intersystems, 1123 Chapala St., Santa Barbara, CA 93101; 805-963-6983.**

Circle No. 315 On Inquiry Card

Optimem's WORM Comes Into The Sun

Each of Optimem's new 12-inch and 5 1/4-inch WORM drives comes with the network optical server (NOS) developed by Symmetrical Technologies, so that the drives can be accessed across Sun NFS networks. The proprietary NOS combines hardware and firmware so that data can be accessed on network hosts, regardless of platform, with special programming or customization of applications. The 4400/NOS 12-inch drive ($22,800) holds up to four gigabytes of data, while the 600/NOS 5 1/4-inch drive ($8,795) can store up to 654 megabytes of data. **Optimem, 297 N. Bernardo Ave., Mountain View, CA 94043; 415-961-1800.**

Circle No. 316 On Inquiry Card

How To Be Mizar-ly With Real-Time

Mizar's Optimum/RT development system for real-time applications incorporates a UNIX subsystem with a VME-bus-based real-time subsystem in a single enclosure, as well as Wind River Systems' VxWorks real-time operating system. It's designed to let you do software development under UNIX and subsequently download and debug the code in a multiprocessing real-time subsystem. Source-level debugging tools are also included.

The standard Optimum/RT system incorporates a 68030-based UNIX subsystem running at 25 MHz with eight megabytes of DRAM (expandable to 64 megabytes), a 68882 floating-point coprocessor, a 140-megabyte disk, and a 150-megabyte streaming tape drive. With the real-time subsystem come options for integrating other Mizar VME-bus-based boards or other peripheral devices, such as IEEE-488, parallel, serial, and analog I/O. Other options include larger disk storage, Ethernet capability, and other workstations; packaging options include tabletop, deskside, or rack-mounted configurations. Quantity-one cost for the Optimum/RT subsystem is $25,995. **Mizar, 1419 Dunn Dr., Carrollton, TX 75006; 800-635-0200; 214-446-2664.**

Circle No. 318 On Inquiry Card

Hardware & Software Support

To **Apple Macintosh**: Network Resources Corp. Mac1000 Ethernet card, supporting twisted-pair Ethernet and AppleTalk phase 1 and 2 (408-263-8100).

To **Arix**: Informix's Wingz spreadsheet (408-432-1200).

To **Convex** C2 supercomputer: Unitree storage management software (214-497-4000).

To **Data General Aviion**: Island Graphics' IslandWrite, IslandDraw, and IslandPaint (415-491-1000); Itasca Systems' object-oriented database (612-851-3155).

continued

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To **DEC 3100**: Island Graphics' IslandWrite, IslandDraw, and IslandPaint (415-491-1000); to **DEC 433MP** multiprocessing system: Informix's Wingz spreadsheet (415-926-6300); Minx's Minxware MRP II software (408-453-6469); to **DEC Ultrix/SQL**: Ingres Tools for data query and creation of 3GL and 4GL applications (415-769-1400); Natural Language front-end database access tool (415-841-3500).

To **HP Apollo**: Aries Technology ConceptStation MCAE software (508-453-5310); Informix's Wingz spreadsheet (415-926-6300); MacNeal-Schwendler MSC/Nastran finite-element analysis software (213-259-3830); and Structural Dynamics' I-DEAS engineering design software (513-576-2469); to **HP Apollo 10000**: Wolfram Research's Mathematica (217-398-0700); to **HP 9000**: Applied Reasoning's PC-Elevator 386 DOS co-processor (617-492-0700); Graphicus' technical graphics and data analysis software (206-828-4691); Intellicorp's ProKappa application development software (415-965-5500); Telesoft's TeleUse GUI builder (619-457-2700); to HP 9000 Series 800 and HP 3000 Model 900 workstations: HP Series 6300 Model 20 GB/A rewriteable optical-disk library (800-752-0900).

To **IBM RS/6000**: Folsom Research's Video/Scan converter for transferring high-resolution video to television video formats such as NTSC, PAL, and RGB (916-983-1500); Ingres' Windows 4GL application development tool (415-769-1400); Island Graphics' IslandWrite, IslandDraw, and IslandPaint (415-491-1000); Natural Language's database access tool (415-841-3500); Objectivity's Objectivity/DB engineering DBMS (415-688-8000); Open Systems accounting software (612-829-0011); Rabbit Software's RabbitPlus 3270-SNA connectivity software (215-647-0440); Sunrise Software's ezX Motif interface development tool (401-847-7868); Telesoft's TeleUse GUI builder (619-457-2700).

To **Intel iPSC/860** supercomputer: ProSolver parallel linear equation solvers, including a direct in-core or out-of-core solver, an iterative equation solver, and a dense equation solver (503-629-7600).

To **Intergraph**: Carter Associates' CAMS Pavement Management System for road work and Sierra Computer Systems' Permits software for government agencies issuing permits and licenses (205-730-2700).

To **MIPS** RISC processors: Wind River Systems' VxWorks real-time operating system (415-748-4100).

To **Motorola** Delta 8000 workstations: Valid Logic's electronic design automation tools (408-432-9400).

To **Next**: Pencom Software's X11.4 server and OSF/Motif 1.1 (512-343-1111).

To **SCO Open Desktop**: Ingres' Windows 4GL application development tool (415-769-1400); Island Graphics' IslandWrite, IslandDraw, and IslandPaint (415-491-1000).

To **SCO UNIX**: HCR/C++ 3.0 object-oriented programming language (408-425-7222).

To **Sequent**: Island Graphics' Island-

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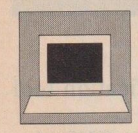

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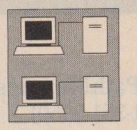

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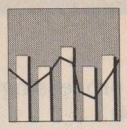

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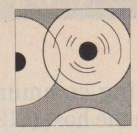

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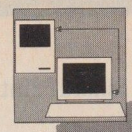

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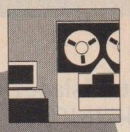

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Write, IslandDraw, and IslandPaint (415-491-1000).

To **Silicon Graphics IrisVision** PC graphics board: Bechtel Software's Walkthru design animation software (508-635-0580); Cadam's Micro Cadam 3-D CAD software (818-841-9470); Dynaware's DynaPerspective 3-D modeling software (415-349-5700); Ithaca Software's IrisView tool for viewing DXF files, based on the HOOPS graphics system (415-523-5900); New Image Industries' See-It rendering and visualization software (818-702-0285); SoftImage's 4-D Creative Environment animation and simulation software (514-845-1636); Spatial Systems' Spaceball interactive device (508-670-2720); Stephen Dedalus' MetaSite CAD and visualization software (919-467-7072); Stereographics' CrystalEyes stereo eyewear (415-459-4500); Time Arts' Lumena painting and image editing software (707-576-7722); Virtual Prototypes' VAPS application development software (514-483-4712); Virtus' Walkthrough visualization software (919-467-9700); Wolfram Research's Mathematica (217-398-0700).

To **Silicon Graphics**: Environmental Systems Research Institute's ARC/Info geographical analysis software (714-793-2853).

To **Sun NewsPrint**: Pacific Rim Data Sciences NewsBlaster System for higher data rates and resolution between SPARCstations and HP and Canon printers (415-651-7935).

To **Sun OpenWindows**: Interactive Development Environment's Software Through Pictures computer-aided software engineering tool (415-543-0900).

To **Sun SPARCstations**: Access Technology's 20/20 spreadsheet (508-655-9191); Cincom Systems' Supra RDBMS (513-662-2300); Ready Systems' VRTX32/SPARC real-time software development tools (408-736-2600); WordPerfect 5.0 (801-222-5006).

To **Tandem Integrity S2**: Unidata's RDBMS (303-756-0897).

To **Texas Instruments 1500**: X/Motif GUI builder and InterSystems' MUMPS-based software applications (800-527-3500).

To **UNIX System V Release 4**: Information Builders' Focus 4GL (212-736-4433); Strategic Systems' Probe/X performance monitoring tool (206-362-2231).

To **X**: Cadkey 3-D CAD software (203-647-0220).

Hardware Upgrades

To **Comtrol** Ultra communications controllers: DT Express drivers for offloading communication processing from the host (612-631-7654).

To **Dialogic** voice processing boards: support for multi-frequency processing (for custom call-processing applications), and pulse code modulation (201-334-8450).

To **Evans & Sutherland** workstations: Fiber Link fiber-optics network interface card (801-582-5847).

To **Hewlett-Packard** printers: Newer Technology offers memory upgrade boards from one to four megabytes for the LaserJet II and III models (316-685-4904).

To **Maspar** MP-1 massively parallel computers: a 17.3-gigabyte parallel disk array mass-storage system; and release 2.0 of Maspar's system software simplifies debugging and programming through a statement-level and function-level profiling tool (408-736-3300).

To **Motorola** MultiPersonal Computer: 64-megabyte memory boards for increased RAM and a one-gigabyte internal disk drive for increased storage; to Delta 3000 servers: one-gigabyte internal disk drive and increased DRAM capacity (408-366-4480).

To **National Instruments** embedded controllers: NI-VXI 2.0 software driver for programming VXIbus systems running under the SunOS (512-794-0100).

To **QMS** color printers: ink rolls specially designed to produce color transparencies (205-633-4300).

To **Silicon Graphics**: a CPU upgrade for Iris 4D/25 users ($5,000) for 33 mips and 6 megaflops performance (415-960-1980).

To **StarGate Technologies** multiport boards: Posix-compliant Streams drivers (216-349-1860).

Software Upgrades

BBN Advanced Computers upgrades the Mach 1000 OS, TotalView debugger, GP1000 C and Fortran compilers, and the pSOS real-time executive for its Butterfly GP1000 parallel processor; for the TC2000 massively parallel supercomputer, it upgrades the nX operating system, Xtra software development toolkit, the TC2000 C and Fortran compilers, and the pSOS real-time executive (617-873-3687).

Cadre Technologies enhances TeamWork 4.0 CASE software with: modules for dynamic modeling and real-time simulation, and for reverse engineering C code; an Ada editor; object-oriented programming support; support for X terminals and heterogeneous networks; and an upgrade of its PathMap design verification tool (401-351-5950).

ComputerTime adds a GUI, the ability to send reports to a file for later transmission or printing, and the ability to record multiple financial transactions, and enhances its 1-Minute Report Writer module in Sales*Advisor 3.0 (416-622-4070).

V.I. Corp. enhances DataViews 8.0 with new graph formatters and object editing capabilities (413-586-4144).

Hummingbird Communications adds support for TCP/IP transport services from Hewlett-Packard, 3Com, Ungermann-Bass, and Beame & Whiteside, Ltd. (416-470-1203).

ICAD Systems enhances its ICAD knowledge-based engineering software with a kernel interface for applications written in C to access ICAD applications, and a GUI builder (617-868-2800).

Interactive Development Environments adds Object-Oriented Structured Design/C++ to the Software Through Pictures CASE products (415-543-0900).

Natural Language replaces its NLI Connector tool with Intelligent Connector (ICon), development tool designed to build, test, and debug applications used to access a relational database (415-841-3500).

NeuralWare enhances its Professional II/Plus neural network development software with FlashCode, a facility for developing embedded applications and generating their C source code; it also supports Neural Semiconductor's DNNA (digital neural network architecture), so neural network applications can be embedded on a single chip for signal recognition and image processing applications (412-787-8222).

Open Systems adds modules for bank reconciliation, time billing to its business accounting software; upgrades its general ledger, payroll, and fixed assets modules; upgrades its accounting software for the construction industry; and upgrades its Canadian version to handle Canada's new Goods and Services Tax (612-829-0011).

Phase II Software adds support for concurrent-user licensing, use over heterogeneous networks, and different display and printout capabilities to ClockWise 1.3 group scheduling and task management software (617-937-0256).

TeamOne Systems adds a point-and-click interface, data compression support, and distributed development support to TeamNet 2.0 engi-

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neering project management software (408-986-9191).

Visix upgrades its Looking Glass graphical desktop environment with graphical views for file system navigation, a hypertext help system; named workspace areas; and a command-line window for editing and submitting commands to a shell from the desktop (703-758-8230).

Westmount Technology enhances the code generation, reverse engineering, and version management in its I-CASE toolsets (31-015-610815).

WordPerfect adds a scheduling module to WordPerfect Office 3.0 for UNIX (801-225-5000).

Compilers & Development Kits

To **Cobol**: Micro Focus Cobol/2 V1.2 upgrade incorporates ISAM file data compression and file key compression (415-856-4161).

To **Motif**: JYACC's GUI builder (212-267-7722).

To **Motorola 68332** processor: Intermetrics Microsystems' RMXDB 5.0 C source-level cross debugger (617-661-0072).

To **Prolog**: Applied Logic Systems' ALS Prolog/386 compiler for System V UNIX (SCO and Interactive), SCO XENIX, and the Sun 386i (315-471-3900).

To **RPG**: Emphasys Software's Cross/36 software lets you migrate IBM System/36-compatible RPG II and RPG III software to IBM's AIX running on the PS/2 or RS/6000 (612-941-9337).

Product Line Extensions

To **AT&T**: the i486-based, EISA-compatible StarServer S uniprocessor server, available with 300 or 600 megabytes of storage (800-247-1212).

To **Comtrol**: MicroChannel- and EISA-compatible Ultra serial controllers (612-631-7654).

To **Evans & Sutherland**: a diskless version of the ESV graphics workstation (801-582-5847).

To **Princeton Graphics Systems**: four high-resolution color monitors, from 12-inch to 20-inch, and from $849 to $3,395; and a new version of the Ultra-X X terminal (404-664-1010).

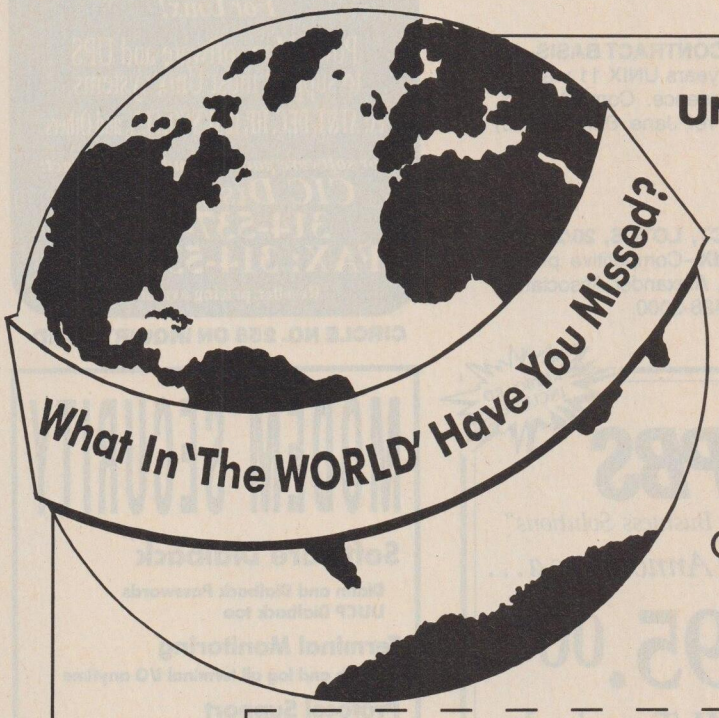
To **Pyramid Technology**: two new MIServer T series high-performance database servers, one with 256 megabytes of storage ($55,000), with one or two processors, and one with 512 megabytes of storage ($245,000), with capacity for four processors (415-965-7200).

To **Raster Graphics**: ColorStation plotters producing schematics at 200 dots per inch (Model 224) and at 200 dpi or 400 dpi (Model 424) on 24-inch-by-36-inch paper (408-738-7800).

To **Silicon Graphics**: the Power Series 4D/310 series, including 4D/310S server ($24,900), 4D/310GTX graphics system ($49,900), and 4D/310VGX PowerVision graphics system ($74,900) (415-960-1980).

To **Visual Information Technologies**: Vitec-30 single-board subsystem for image processing (214-596-5600).

And to **Cubix** (702-883-7611), **IBM** (800-426-2468), **Mobius Computer** (800-662-4871), **Wang** (508-459-5000), and **Zenith Data Systems** (800-553-0331): i486-based PCs. ■



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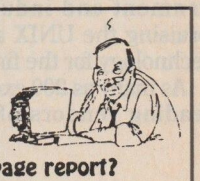

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continued from page 157

professional publishing systems. This includes color production, publishing without paper, emerging industry trends, and specific systems applications. Also on the roster is the New Products Showcase demonstrating an informal, hands-on vendor exhibit.

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McGraw-Hill's 2nd Executive Symposium on UNIX and Open Systems: March 6-7
Datapro Canada information services and Unican will jointly sponsor the Symposium on UNIX and Open Systems. This symposium is for MIS executives of large end user organizations in government and industry that are appraising the UNIX and open systems technology for the first time.

As many as 200 executives, as well as leading vendors of UNIX and open systems, are slated to attend. The conference will be held at the Prince Hotel, Toronto, Canada. Contact Kal Juman, McGraw-Hill Information Systems, 416-298-1177.

Communication Technologies Conference: March 6-7
Harry Newton, publisher of *Teleconnect*, will deliver the keynote address on "Applying Voice, Data, Image, and Video to Business and Industry." This national conference focuses exclusively on communications technologies of the 1990s.

In two days of sessions, top business and industry communications leaders will offer insights on business solutions and opportunities for existing and future technologies. Among topics to be discussed are voice processing systems, global networking expansion, EDI, TCP/IP, intelligent networks, and Fractional T-1. The conference will be held at the Washington Hilton and Towers, Washington, D.C. Contact Audrey Frishman, Technology Interchange Group, 201-478-3606. ■

NEXT MONTH IN UNIXWORLD

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Much of your business depends on the information kept in your database. What would happen if you needed to move that data to another database? The shocking truth: it's not easy.

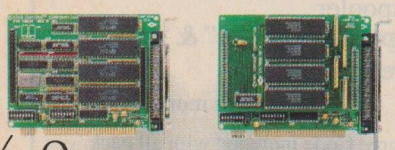
It's All Relative at SCO

Doug Michels and father Larry comprise one of the unique management teams in computing. March's Profile looks at Doug's insight into the UNIX industry, and working for his father.

The Object of Your Desires

Will you be storing data in an object-oriented database soon? If you're considering this new technology, here are our guidelines on choosing a product.

Multiple-Choice



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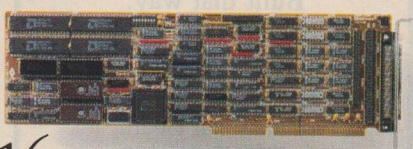

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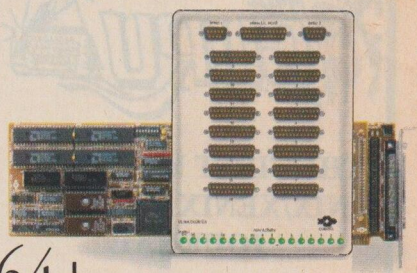

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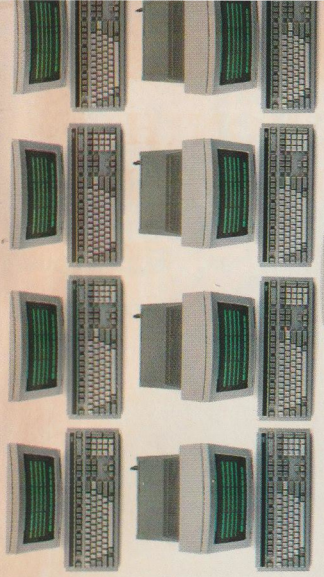

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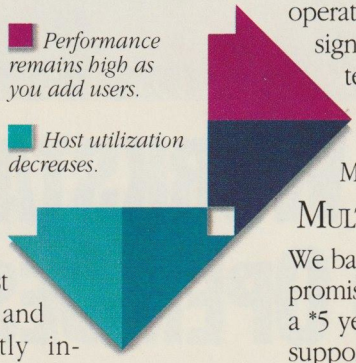

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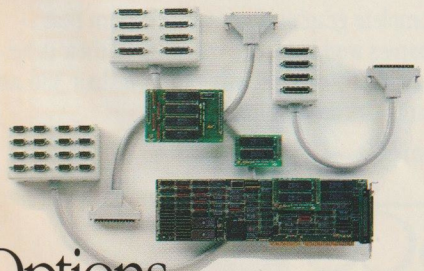

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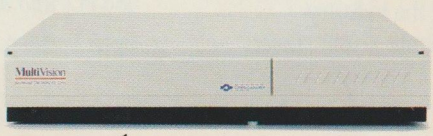

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